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THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

DARWINIAN ETHICS AND ITS PRACTICAL APPLICATIONS[1]

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IT not infrequently happens that when one is called upon to deliver a presidential address he chooses a subject quite outside his own field of competence. This procedure has its dangers, of course, especially for the naive and unwary. In extenuation of my own intrepidity in venturing to discuss Darwinian ethics I may explain that in spite of the extensive literature which this subject has called forth it has rarely received adequate treatment and is not infrequently grossly misrepresented. Few people who accept the Darwinian theory of evolution realize its far-reaching import, especially in the social sciences. Sir Arthur Keith has remarked that "even our leading biologists and masters of history are evolutionists only from the lips outwards." The same statement is even more applicable to writers on ethics. Although there has been a number of relatively scholarly discussions of Darwin's views, in most books on morals the Darwinian standpoint is presented, if at all, in a few words, followed by a more elaborate criticism of the ethics of Spencer, which has commonly been treated as typifying the ethics of evolution. The subject has now lost its novelty. Ethics is still closely affiliated with metaphysics and theology, and Darwin,

[1] Presidential address before the Western Division of the American Association for the Advancement of Science, Stanford University, June 27, 1939.

having been assigned to his proper little niche, is passed by with little appreciation of the real extent of his contribution.

Darwin's views on ethics are a logical outgrowth of his theory of the causes of evolution. Although this theory has encountered no dearth of adverse criticism, I think I am justified in saying that its essential features are now more widely accepted than at any previous stage of its history. Certainly no other theory has succeeded in approaching the status of a formidable rival. If we assume that this theory is correct and carry it out consistently in all its implications, where will it lead us in the field of ethics? On this assumption we, like the lower animals, owe our native endowments of mind and body to the preservation of favorable variations in the struggle for existence. Our explanation of how we came to be constituted as we are falls into the same general formula as our explanation of the origin of a tough hide or sharp teeth. These latter characteristics are obviously very useful adjuncts to survival in this world of strife, and natural selection would seem to be peculiarly suited to afford a naturalistic explanation of their origin. But the attempts to explain man, with his superior intelligence, his high sense of duty and his capacity for esthetic appreciation and religious feeling as the outcome of the same process of selective survival naturally aroused strenuous opposition. The co-discoverer of the principle of natural selection, Alfred Russell Wallace, who was more of a natural selectionist than Darwin in relation to most evolutionary problems, stopped short of applying the theory of natural selection to explain the distinctive endowments of man. A similar position is held by many philosophers and liberal-minded theologians and by the more enlightened leaders of Catholic thought who accept the doctrine of evolution. But Darwin, who had become pretty much emancipated from all theological prepossessions when he wrote the "Descent of Man," was of a different cast of mind. In the "Origin of Species" he said almost nothing in regard to the application of evolution to the human species, beyond the remark that "light will be thrown upon the origin of man and his history." But it was this very aspect of Darwin's theory that made the strongest impression upon people in general, who were much more concerned with their own origin and what this might imply than they were with speculations on the origin of species.

The "Descent of Man" formed an original and very apposite sequel to the "Origin of Species" because it afforded the opportunity to round out the general doctrine and to show its important bearing on human psychology and the social sciences. Aside from that part of the work dealing with sexual selection, the "Descent of Man" is devoted to setting forth the evidence from morphology, embryology, etc., indicating the descent of man from animals resembling the apes, to showing that the human intelligence differs from animal intelligence only in degree instead of in kind, and that morality, and even religion do not imply the possession of unique endowments but are outgrowths of man's superior intellectual development and the social instincts and emotions which man shares to a certain extent with the higher mammals. In the "Descent of Man" Darwin ventured upon relatively unfamiliar territory when he discussed the moral sense and the standard of ethical conduct. Traditionally, the field of ethics had been appropriated almost exclusively by theologians and philosophers. Darwin, who never concerned himself with the subtleties of metaphysics, approached the subject apologetically, with the remark that the moral sense "has been discussed by many writers of consummate ability and my sole excuse for touching on it is the impossibility of here passing it over; and because, so far as I know, no one has approached it exclusively from the side of natural history." Only as a naturalist, therefore, did Darwin presume to touch upon the great problems of morals, and he did so for the simple reason that it lay across his path. If man is, as Spencer states, organically moral, Darwin's theory must be able to explain how he came to be so. A thoroughgoing Darwinian can hardly afford to admit the existence of entirely unique endowments that do not have at least their roots in more primitive forms of life.

Social life in animals is possible only on the basis of a certain degree of altruism. As Zell has shown in his work on "Morale in die Tierwelt," animals have a sort of moral life which in its fundamental features is much like our own. Man is a social animal, and because of this fact he is a moral animal.

> Any animal whatever [says Darwin] endowed with well-marked social instincts, the parental and filial affections being here included, would inevitably acquire a moral sense or conscience as soon as his intellectual powers had become as well or nearly as well developed as in man . . . the moral sense follows, firstly, from the enduring and ever-present nature of the social instincts; secondly, from man's appreciation of the approbation and disapprobation of his fellows; and thirdly, from the high activity of his mental faculties, with past impressions extremely vivid. . . . Owing to this condition of mind, man can not avoid looking both backwards and forwards, and comparing past impressions. Hence after some temporary desire or passion has mastered his social instincts, he reflects and compares the now weakened impression of such past impulses with the ever-present social instincts; and he then feels that sense of dissatisfaction which all unsatisfied instincts leave behind them, he therefore resolves to act differently for the future—and this is conscience.

This view of the origin and nature of conscience, here sketched in merest outline, was utterly at variance

with the prevailing notions of the time. Conscience has always proven to be a very troublesome faculty for the moralists anyway. The recent searching analysis by T. V. Smith in his volume "Beyond Conscience" has effectually disposed of most of the attempts to justify conscience as a dependable guide to good conduct. If we grant that conscience always means well, we must remark that it has often approved the burning of witches and heretics, and countless other foolish and wicked actions. Apparently there is no atrocity or baseness that it will not condone if it is subjected to the right sort of preliminary education. No one, except perhaps Nietzsche and his followers, would deny that conscience, despite its obvious shortcomings, is a very valuable if not indispensable aid to decent living in an organized society.

That conscience is not infallible when it might be expected to be according to many theories of its nature and origin has sorely perplexed moral philosophers for ages. But the annoying imperfections and inconsistencies of this unreasonable faculty are not at all disturbing to one who considers it purely from the standpoint of natural history. When the Darwinian looks on the organic world he expects to find adaptation, at least in a broad and general way, but not perfection. He is as much pleased with a vestigial eye or a useless ear muscle as he is with a remarkable case of protective coloration. They are all grist for his mill, provided that their origin may plausibly be interpreted according to the principle of natural selection. A conscience that is always right would fill the Darwinian with dismay.

It is evident that conscience is no single discrete faculty or organ of the mind, but a general term for a class of intellectual and emotional reactions. Its emotional components impel us to follow what we judge to be right, and our judgments on this score are usually determined by the mores of our associates. Its voice is the voice of the group or, as Clifford has called it, the tribal self. We are social animals endowed with social instincts which make us sensitive to the esteem or disregard of our fellows, and with sufficient intelligence to reflect upon our acts and to judge them in accordance with prevailing standards. Hence, according to Darwin, we are moral animals and have a conscience which is on the whole a fair though far from perfect guide to the kind of conduct which meets with moral approval.

Unquestionably, one of the greatest contributions of Darwinism to the social sciences is the light which it throws on the constitution of human nature. The traditional explanation prevailing in Darwin's time was that man is as he is because he was so created, although his original divine image was sadly marred as a result of the fall and the continued machinations of Satan and his cohorts of evil spirits. From the moral standpoint man is an exceedingly variable animal. He is at once courageous and cowardly, kindly and cruel, honorable and deceitful, proud and humble, generous and grasping, just and partial. He is capable of attaining sublime heights of moral excellence, and, on the other hand, there is no depth of infamy and degradation to which he will not descend. We need not concern ourselves with the theological interpretations of these remarkable diversities of character. Devils, evil spirits, principles of evil and doctrines of total depravity, notwithstanding the high ability and profound learning of many of their apologists, we may dismiss without further comment. The efforts of the various proponents of the experience philosophy to explain the development of mind and character have proceeded along much more scientific lines, but their failure is now commonly recognized. It is a noteworthy fact that up to the time of Darwin we had no scientific explanation of human nature that was worth a rap. The history of human thought is strewn with interpretations of human nature of the most artificial and wooden description. Man has never understood man, and the worst feature of this failure is that his misunderstandings have been fraught with incalculable evils throughout the course of human history. Flogging the insane and keeping them chained in filthy dungeons, the barbarous treatment of criminals and the petty cruelties inflicted in the discipline of children are among the many evils growing out of mistaken views of the nature of man which are gradually giving way to a more rational understanding. With a more scientific interpretation of man the cruelties of witchcraft, the horrors of religious persecution and the multitudinous barbarous practices that have been the outgrowth of superstition would not have occurred. Human history has emphasized the tremendous importance of the maxim, "Know thyself." For ages man has occupied the unfortunate position of a sort of meeting ground between the natural and the supernatural. Through sorcery and other magic powers he might influence others for good or for ill, and demoniacal possession accounted for disease. The demons are not yet all exorcized by the growing light of science, but our progress toward a rational understanding of the human animal has been among the most potent influences in humanizing man's treatment of his fellow man.

In organized society a large part of our activities consists in dealing with other people. Obviously, the better we understand our fellow creatures the better we should be able to deal with them effectively. It is only within the past two or three generations that educators have discovered that it is necessary to understand children in order to educate them in the proper way. The natural aptitudes, instincts and interests of the child were largely disregarded and he was put through a regimen which was prescribed on *a priori*

grounds, and frequent flogging was resorted to in order to supply an adequate motive for serious application. In dealing with criminals, delinquents and the insane, as well as with normal human beings, we need not merely good intentions but insight and understanding. Hence, any theory that throws a flood of light upon the nature of man and the whys and wherefores of human behavior can not fail to have a salutary influence on all our efforts at moral reform.

The Darwinian theory, I believe, does just this. One who accepts the Darwinian theory of natural selection and applies it consistently has, so to speak, his interpretation of human nature cut out for him. Man's traits, in so far as these are a part of his inheritance, owe their origin and biological meaning to their survival value. In fact, the Darwinian theory could not well account for the evolution of any other kind of creature. All the natural traits and impulses of human beings must therefore be fundamentally good if we consider the good as the biologically useful. Cruelty, selfishness, lust, cowardice and deceit are normal ingredients of human nature which have their useful role in the struggle for existence. Intrinsically they are all virtues. It is only their excess or their exercise under the wrong conditions that justly incurs our moral disapproval. For the Darwinian the categorical distinctions between good and bad take on a new meaning. His standpoint is, in Nietzschean phraseology, "beyond good and evil." The old distinctions between sins, venial or otherwise, and ordinary wrong acts melt away. Immutable principles of good and evil go by the board. They are the inventions of philosophers and have no place in reality. What we call bad conduct is usually the result of maladjusted egoistic impulses that are not properly subordinated to the needs of social life. Our good conduct, on the other hand, commonly springs from social impulses which the Darwinian would explain as the result of group selection. As expressed by a thoroughgoing Darwinian, Professor Karl Pearson:

> The struggle among primitive men of tribe against tribe evolved the social instinct. The tribe with the greater social feeling survived; we have to thank the struggle for existence for first making man gregarious and then intensifying, stage by stage, the social feeling. Such is the scientific account of the origin of our social instincts; and if you come to analyze it, such is the origin of what we term morality; morality is only the developed form of the tribal habit, the custom of acting in a certain way toward our fellow beings, upon which the very safety of the tribe originally depended.

If this gives us a true natural history of our moral sense, we should not be perplexed by the great diversity of character exhibited by different men. Man, as we should expect in the light of his origin, is no angel; neither can he be accused of total depravity in the absence of divine grace. He is loyal and sympathetic toward his own, hostile to the stranger, amenable to leadership and subordination and willing on occasion to sacrifice his own welfare in the interest of his group. At times he is cruel, revengeful, cowardly or otherwise a pliant creature of his purely self-regarding impulses. In the eternal conflict between egoism and altruism he obeys now the one and now the other kind of urge. Human nature bears the imprint of having been molded in the stern school of strife. On the whole it is just about what we would expect it to be in the light of its method of evolution.

If we wish to gain a proper insight into the native and uncamouflaged impulses of human beings there is perhaps no more instructive procedure than to study the group behavior of chimpanzees. There you will find the mutual sympathy, the group pugnacity, the egoism and the altruism which are so curiously blended in man. They are more crudely exhibited, to be sure, but they have a more adequate adjustment to the needs of the group.

"Nature," says William James, "implants contrary impulses to act in many classes of things and leaves it to slight alterations of the conditions of the individual case to decide which impulses shall carry the day." It is this endowment of varied and seemingly contradictory traits that accounts largely for the remarkable diversity of human character to which I have alluded. Basically, most of us have the same natural impulses. Our differences of character, like our differences of bodily structure, are mainly matters of emphasis. If the purely egoistic impulses are grossly hypertrophied we may become highly undesirable members of society. On the other hand, normally virtuous tendencies may become vices if carried to excess. After all, there is much wisdom in Aristotle's doctrine of the Golden Mean.

We sublimated simians have no reason to be ashamed of our origin. We owe to our more primitively moral ancestors our good as well as our bad traits. Our nature is much less closely adapted to the environment in which we live, for reasons very easy to understand. We owe much more than any lower animal to the influences of our environment. This environment has changed greatly in the last few thousand years. Human nature seems to have been developed for life in small, quarrelsome clans which afford ample opportunity for the exercise of the complementary traits of mutual aid and group pugnacity. The complex civilization which has appeared in recent times has developed so rapidly that the innate endowments of man have not kept pace with environmental changes. We shall probably be more and more concerned with problems arising out of the maladaptiveness of human nature to its conditions of life. For the proper solution of these problems, therefore, a really scientific under-

standing of human nature will become more and more imperative.

The influence of Darwin upon ethics consisted not only in giving us a new standpoint in relation to human nature, including man's moral sense, but in affording a standard of right and wrong which, if not necessarily associated with the doctrine of natural selection, is a perfectly logical and consistent conclusion from Darwinian principles. The proper standard of conduct is a subject upon which moralists have furnished us with a most varied assortment of theories. Throughout the recorded history of mankind most peoples have lived under moral codes which were assumed to owe their origin and binding force to supernatural authority. A perfectly typical example of such a system is furnished by the ancient Hebrews, who were instructed concerning right and wrong by special revelations from Jehovah, who not only furnished them with the Ten Commandments, but, through the inspired authors of Leviticus and Deuteronomy, with meticulous instructions as to what they should and should not eat and the fine points of conducting sacrifices. For the Hebrew being good consisted in acting according to the revealed code, and sin was disobedience. When our original parents ate the forbidden fruit, when all the inhabitants of the earth, with the exception of Noah and his immediate family, departed from ways of righteousness, when the inhabitants of Sodom and Gomorrah were given over to their scandalous ways and when the unfortunate Onan ventured on the first recorded experiment in contraception, an outraged Jehovah visited upon them the full measure of his wrath. It behooved the faithful Hebrew to walk in the ways of the Lord. That was morality.

The ethical teachings of Jesus, though greatly refined and humanized as compared with those of the Jews in their semi-barbaric period, were still authoritarian in character. Amid the various modifications of ethical doctrine that had grown up during the history of Christianity, the authoritarian basis of morals, in one form or another, has remained one of its most stable features. In the Roman Catholic church this doctrine has come to be more deeply intrenched, inasmuch as this body has definitely claimed to be the final court of appeal on all questions of morals as well as religion. Here we have perhaps the sharpest and most vital issue that remains between science and theology. Catholicism purports to speak on matters of morals with a voice from which there is no appeal. Questions of astronomy have long since been passed over to the astronomers. The healing art, once held to be the peculiar province of the priest, is now generally, but by no means exclusively, conceded to be the legitimate occupation of the physician. But in the opinion of a large part of even the educated public the field of morals belongs not to the scientist but to the man of God. Supernaturalism in morals is still very much alive. Not only does it continue to enjoin many observances of no intrinsic moral significance, but it is very influential in determining attitudes on many questions of real importance. There is, of course, a broad basis of agreement in practically all moral codes. Murder, lying, stealing and adultery are all condemned in almost every list of forbidden acts, but of course no code can cover all the varied situations in which questions of right and wrong may arise. There are many problems of morals upon which people differ sharply. Among these we may mention the justification of divorce, birth control and euthanasia. When we look into the alignment of opinion on these controverted questions we find that it is determined largely by whether or not the individual forms his moral judgments on the basis of authority or upon considerations of human welfare. There is no gainsaying the fact that whether our moral judgments are determined by authority, the greatest happiness principle, the categorical imperative, some form of self-realization or the Darwinian criterion of rightness may determine our attitude on many important moral problems.

Where differences of opinion as to the morality of an act arise from differences in criteria by which the act is judged, discussion comes to an *impasse*. If agreement is reached it is only when both parties come to view the act from a common standpoint, such as the promotion of human welfare, which they both adopt in principle, whether consciously or not. In our present age notions about the basis of morals vary greatly. The rank and file of people still base their conduct on some form of authoritarian ethics, and the authority is coming to have less and less hold upon them. Many drift along with no clearly defined moral standpoint, being guided by their natural impulses under the restraining influence of law and custom. For the most part they get along fairly well. After all, social instinct and social traditions are much more effective than moral philosophy in keeping people in the straight and narrow path.

The common criticism directed against standards of conduct is that their practical application would lead to very undesirable consequences. Evolutionary ethics, especially Darwinian ethics, has been denounced as subversive of everything that humanity has considered most worthy. Darwinism consistently applied would measure goodness in terms of survival value. Darwin never developed this phase of his doctrine fully, but his view is indicated by the following remark made in discussing general happiness as a standard of conduct: "The term general good may be defined as the rearing of the greatest number of individuals in full vigor and health, with all their faculties perfect, under the con-

ditions to which they are subjected. As the social instincts, both of man and the lower animals, have no doubt been developed by nearly the same steps, it would be advisable, if found practicable, to use the same definition in both cases, and to take as the standard the general good or welfare of the community rather than the general happiness." According to this viewpoint, the end of the moral life, speaking teleologically, is the same as the biological life of the organism. Morality becomes just one phase of the adjustment of the organism to its conditions of existence. As a good body is one which runs smoothly and efficiently in the maintenance of its vital functions, so a good man is one whose conduct not only maintains his own life on an efficient plane, but conduces to the enhancement of the life of his social group. In making the preservation and perpetuation of life the true function of morals, as it is a function of life itself, Darwinism affiliates ethics more closely with the biological sciences. Moral life is the expression in human conduct of true and effective living. Through being moral we have life, and have it more abundantly.

Of course, human beings are free to choose any criterion of conduct they please and to order their lives accordingly. There may be a number of perfectly justifiable ends of moral endeavor. The Darwinian, however, would maintain that, wittingly or not, people have been led to approve of conduct that makes for survival and to condemn conduct that is socially destructive. As Walter Bagehot remarks in his "Physics and Politics," "the moral groups cohere and therefore prevail." Tribes having the most effective codes have continually been selected in the competition of opposing groups. Peoples may believe that their moral customs derive from a supernatural source, but one potent reason for their adoption is their conduciveness to survival. The Darwinian standard may be said, therefore, to be in a sense nature's own. If peoples depart too widely from the kind of conduct it prescribes, they are courting the fate of all ill-adjusted variations in the struggle for life.

The Darwinian would maintain that his standard makes explicit what is implicit in all codes in so far as their prescriptions are morally valid. Although peoples may ascribe the origin of their codes to the commands of their gods, or whatever else, the true cause for their development is their survival value. Whether or not we agree with Ritchie that "natural selection . . . is a perfectly adequate cause to account for the rise of morality," we must concede that it affords a plausible interpretation of the differences in the moral codes of peoples living under different conditions. Although there is a good deal of maladjustment in the moral customs of peoples, as there is elsewhere in organic nature, differences in moralities, as Westermarck has shown in his "History of Moral Ideas," are to a large extent explicable as an outgrowth of the varied environments to which a people must adjust itself.

In speaking of applying the concept of natural selection in the field of ethics I must here guard against a possible misinterpretation. The application of the principle of selection to interpret the adaptive modifications of moral codes does not compel one to assume that moral sentiments and, still less, the particular acts which are approved or condemned, are matters of biological inheritance. In social evolution tradition plays a role very similar to that of heredity. Complex sentiments as such are not transmitted through the germplasm, although they may rest upon a basis of instinctive components. Tribes with the best codes will tend to prevail, whatever be the method by which the more useful moral customs are handed on. Natural selection has made man a social animal as a result of his heredity. Selection, experience and social tradition have led him to adopt moral practices which favor survival.

There are many people who are very suspicious of Darwinian ethics and are disturbed over what might happen if we proceeded to order our conduct in accordance with its dictates. I think that we can assure ourselves that nothing very dire would happen, because to a large extent people order their lives according to its dictates now. They really approve honesty, courage, loyalty and benevolence because these qualities have led to greater fulness of life. Fundamentally, therefore, our ethics is Darwinian, whether we like it or not. It is only imperfectly so, however, and I venture to suggest that current moral practice might be considerably improved if it became more consciously and definitely regulated in terms of the Darwinian standard.

There are several ways in which the practical application of Darwinian principles would affect our conduct and our ideals. One can not imagine a Darwinian finding anything particularly heinous about eating meat on Friday or playing cards on Sunday. Neither, if smitten, would he be likely to turn the other cheek. On occasion he would feel quite justified in going to war. He would doubtless contend that conflict has played an important role in shaping the evolution of man, although if he followed Darwin and many of his adherents, he would point to the highly dysgenic effects of modern warfare. He would emphasize the importance of eugenics, both positive and negative, and all measures that make for healthful and wholesome life and the improvement of its adjustment to its environing conditions, material and social. For every ethics that seeks its sanctions in the welfare of mankind every moral problem is a scientific problem to be solved like other problems by the employment of scientific

methods. For such a view-point ethics is not a field that can be sharply demarcated from other disciplines and made the province of priestly authority. As John Dewey remarks, "ethics is ineradicably empirical, not theological, nor metaphysical, nor mathematical. Since it directly concerns human nature everything that can be known of the human mind and body in physiology, medicine, anthropology, and psychology is pertinent to moral inquiry."

A scientific ethics would insist, as the Greeks did, upon the moral obligation of wisdom. One unfortunate influence of Christian ethics has been its tendency to divorce wisdom from morality. The good will alone is a very inadequate guide to good conduct. It is impossible to be really effectively good without being wise. There are circumstances under which practically all rules must be broken in order to lead the good life. Where different codes are followed in a community there is bound to be more or less conflict of moral aims. The people of Christian nations profess allegiance to a code which the exigencies of their life compel them to continually violate. The result is confusion and conflict and a constant incentive to hypocrisy.

In many ways the attempt to follow authoritarian ethics leads to conduct at variance with that which is dictated by considerations of human welfare. One of the most serious obstacles to several moral reforms is the blind adherence to moral codes that command unquestioning obedience. Were all questions of morality frankly recognized as scientific problems, much of the conflict I have mentioned would disappear. Many unsettled problems would of course remain, but by the applications of scientific methods they might finally be settled. It is only through becoming a true science that ethics can perform its greatest service. In this respect ethics is on precisely the same footing as medicine and other fields of applied science. Darwin, the great naturalist, in approaching ethics purely from the standpoint of natural history in the two famous chapters in his "Descent of Man," has contributed greatly toward making ethics scientific, and hence of greater value to mankind.

THE STANFORD UNIVERSITY MEETING OF THE PACIFIC DIVISION

Edited by Professor J. MURRAY LUCK
SECRETARY

THE twenty-third annual meeting of the Pacific Division, American Association for the Advancement of Science, and of seventeen associated societies was held at Stanford University, California, during the week of June 26, 1939.

The meetings may be considered noteworthy in several respects. They were characterized by a number of symposia of outstanding quality and were followed by a five-day symposium of fascinating interest on "The Cell and Protoplasm." Following upon this, in turn, was the sixteenth National Colloid Symposium, which brought to the university a third contingent of distinguished visitors. The results of such meetings can never be properly evaluated. The stimulus to scientific research is admittedly great, and the interest awakened within the layman in the contributions of science to the social order is, we suspect, more than transitory. The only index available for measuring the "success" of the meeting is to be found in the registration figures—a total of 882 for the divisional meetings alone. This is much greater than that of any previous meeting and may be compared with the registration total of 377 at the last Stanford University meeting (1924).

All the general sessions were held in the Memorial Theater and in Cubberley Hall—two new buildings provided with excellent auditoria and other facilities necessary for large meetings of this character. Guests were housed in Lagunita Court—a splendidly equipped dormitory which was placed in commission by the university only a few years ago. In every respect the material facilities were all that could be desired.

Local arrangements for the meeting were in the care of a committee consisting of S. B. Morris (*chairman*), Ernest R. Hilgard (*secretary*), Norris E. Bradbury, Eliot Blackwelder, Paul H. Kirkpatrick, Eliot Mears, George S. Parks, Templeton Peck, Gilbert M. Smith, Victor C. Twitty.

The first general session, which was held on the morning of June 27th, took the form of a symposium on "Radiation and Life." Four invited speakers participated. Since it is manifestly impossible to describe in detail the papers presented, it may be sufficient to list the titles and speakers: "Radiation," W. V. Houston, California Institute of Technology; "Radioactive Elements as Tracers in Metabolic Studies," John H. Lawrence, University of California; "Radiation and the Hereditary Mechanism," M. Delbruck, California Institute of Technology; "Medical Applications," Robert R. Newell, Stanford University Hospitals.

The afternoon of the same day was devoted to surveys of current research—a program which has been repeated annually by the division for many years. J. W. McBain, of Stanford University, reviewed a

number of the recent advances in colloid chemistry. A. R. Davis, of the University of California, dealt with mineral metabolism in plants, and H. Borsook, of the California Institute of Technology, surveyed some of the recent contributions to knowledge in that lively field of research, biological oxidations and reductions. A paper in the field of psychology was contributed by J. W. Macfarlane, of the University of California, who discussed research on personality development.

The evenings of Tuesday, Wednesday and Thursday were given over to addresses of general interest to the visiting members as well as to the lay public. That of Tuesday evening by Professor S. J. Holmes, president of the Pacific Division, on "Darwinian Ethics and its Practical Applications" evoked a great deal of interest and much comment in the press because of its challenge to authoritarian concepts of right and wrong. On Wednesday evening Professor V. Gordon Childe, of the University of Edinburgh, presented an address on the neolithic economy in northwestern Europe—a subject in which he is a recognized authority. The concluding address of the series, delivered by Professor J. D. Bernal, of the University of London, consisted of a graphic description of the structure of protein molecules.

Several events of a social character were arranged for the entertainment of visiting members and guests. Mention should be made of the reception tendered by the university on Tuesday afternoon, a visit to several private gardens in the Palo Alto—Atherton region and a special concert by the Roth Quartette on Friday afternoon.

In addition to organized visits to the Ryan High-Voltage Laboratory and the Laboratory of Plant Biology, Carnegie Institution of Washington, attractive excursions were made to Lick Observatory on Mount Hamilton, the Radiation Laboratory of the University of California and the Hopkins Marine Station at Pacific Grove.

Meetings of the executive committee and of the council were held in the course of the week. Dr. Lewis M. Terman, professor of psychology at Stanford University, was elected to the presidency of the division for the ensuing year, and R. E. Clausen and J. Murray Luck were reelected vice-president and secretary-treasurer, respectively. Ian Campbell, of the California Institute of Technology, was elected to the executive committee in succession to W. V. Houston, who retires on completion of his term of office. E. O. Essig, of the University of California, and C. V. Taylor, of Stanford University, were elected to the council as members-at-large for the customary four-year term.

Announcement was made that the next meeting, national in character, will be at the University of Washington, Seattle, during the week of June 17, 1940.

SESSIONS OF AFFILIATED SOCIETIES

Seventeen of the affiliated and associated societies participated in the meeting, and over 440 papers were presented. The reports of the various sessions follow.

AMERICAN PHYSICAL SOCIETY

(Report by Paul Kirkpatrick)

Sessions for the presentation of brief contributed research reports were held on Thursday, Friday and Saturday forenoons. These reports, fifty-seven in number, touched upon theoretical and experimental investigations in varied fields, with nuclear researches in the place of prominence.

Three symposia, concerned with applications of physics in the adjacent fields of astronomy, electrical engineering and biology, were presented at the afternoon sessions. On Wednesday afternoon the society met in joint symposium with the Astronomical Society of the Pacific to consider the phenomenon of limb darkening. Papers by C. D. Shane, Edison Pettit and A. B. Wyse on aspects of this problem were followed by a paper on the design and construction of the 60-inch cyclotron by E. M. McMillan. The symposium of Thursday afternoon presented aspects of the ultra-high frequency radio investigations in progress in the Stanford Physics Department. Papers by W. W. Hansen, D. L. Webster and S. F. Varian were accompanied by demonstrations of new devices (Rhumbatrons, Klystrons) applicable to communication. A symposium on methods and results of x-ray structure determination, held on Friday afternoon, was addressed by M. L. Huggins, J. D. Bernal and O. L. Sponsler, the first speaker defending the hypothesis of the existence of hydrogen bridges in crystals, and the succeeding ones discussing respectively the structures of plant virus particles and of the super-molecules of protein and cellulose existing in living organisms.

A dinner on Thursday evening, organized jointly by the American Physical Society and the Astronomical Society of the Pacific, was addressed by J. D. Bernal, who spoke of the social and human responsibilities of science.

AMERICAN METEOROLOGICAL SOCIETY

(Report by John A. Riley)

The American Meteorological Society held five sessions, with twenty-eight papers on the program. About one hundred persons were present.

The first session on Wednesday morning was concerned primarily with the meteorological problems of the Pacific Ocean as related to the weather in the western United States and Alaska and to transpacific aviation. In the absence of Dr. Reichelderfer, chief of the Weather Bureau, Major E. H. Bowie gave a

brief report on pending developments in meteorology, stressing the need for expansion and improvement of the vessel weather reporting service in the Pacific, with four complete reports daily. W. H. Clover spoke on the relation of meteorology to the operation of Pan American clippers across the Pacific; T. R. Reed discussed the relations between the general pressure field and the weather in California. "Occlusions on the Alaska Coast'" was the subject of A. B. Carpenter's paper.

The afternoon session was devoted to upper-air investigations and their application to forecasting and to aviation. A new field of observation and research has been opened by the use of the radiosonde, which now penetrates the stratosphere daily and transmits by radio data on the atmospheric conditions aloft for current use. A résumé of the first year of these observations at Oakland was presented by J. W. Smith and C. R. Elford. E. M. Vernon discussed a constant level synoptic chart based on free air data. John A. Day spoke on aviation wind forecasts for long hops over the Pacific, and C. L. Smalley demonstrated an instrument for rapid calculation of winds at flying levels from pressure and temperature fields and adaptable for use on charts of various size. Results of an investigation of cloud heights over the Plateau Region, referred to sea level, were reported by H. Dean Parry, of Salt Lake City.

A symposium on atmospheric radiation on Thursday morning consisted in the demonstration of instrumental equipment, theoretical studies and practical applications. L. W. K. Boelter, of the University of California, discussed the construction and operation of a sensitive yet inexpensive radiometer for use in measuring nocturnal and terrestrial radiation. C. Lorenzen, Jr., gave a report on some results obtained with the instrument in citrus orchards during the frost season. Walter M. Elsasser, of the California Institute of Technology, reviewed the theoretical considerations leading to a graphical method for the determination of radiative transfer. Edward M. Ashburn discussed the application of these results in computing the transfer of heat in the lower layers of the atmosphere in connection with summer stratus clouds on the California coast.

In the afternoon, N. E. Bradbury, of Stanford University, described the theory and practice of a continuously recording apparatus for the measurement of the density of atmospheric condensation nuclei; a report on the diurnal variation and vertical distribution of these nuclei was given by E. A. Yunker. The results of measurements of atmospheric charges with electric field recorders were presented by R. E. Holser, of the University of New Mexico. "Statistical Relationships of Seasonal Rainfall Records," by Charles P. Conroy, was followed by a report on varves and rock strata as recorders of cycles by Halpert P. Gillette.

During the last session, in "Melting Snow as a Flood Factor in the Sierra Nevada," E. H. Fletcher pointed out that, contrary to popular belief, the melting of snow by rain alone is a slow process and the presence of considerable snow on the ground acts as a damper in retarding a rapid run-off. C. P. Smith pointed out the need of accurate temperature forecasts for natural gas dispatching in California. Dean Blake spoke on the origin of tropical Pacific air in the Southwest, R. C. Counts on storm effects on tides in the Golden Gate and A. Breese on meteorological aspects of a historic disaster in Moscow. E. E. Eklund explained administration of the San Francisco Weather Bureau. The sessions closed with an illustrated talk on Alaskan and western mountains as climatic factors by L. H. Daingerfield.

ASTRONOMICAL SOCIETY OF THE PACIFIC

(Report by Gerard F. W. Mulders)

A joint session was held with the American Physical Society on Wednesday afternoon, June 28, with an attendance of about eighty. C. D. Shane, University of California, gave an outline of the theory of limb-darkening for a star and discussed the importance of limb-darkening measurements as a means of determining the wave-length dependence of the continuous absorption coefficient. Edison Pettit, of the Mount Wilson Observatory, described measurements of the limb-darkening in the sun and in the stars, respectively.

E. M. McMillan, of the University of California, described the design and construction of the recently completed 60-inch cyclotron at Berkeley. This instrument, the largest of its kind in the world, is capable of producing deuterons with an energy of 16.5 million volts.

Sessions for papers were held on Thursday, June 29, with an attendance of about forty-five. Twenty papers from five different institutions were presented and several points of special interest were noted. J. H. Moore reported on a spectroscopic determination of the rotation period of Saturn, showing that this planet rotates more slowly at higher latitudes than it does near the equator, which is similar to the rotation of the sun. R. M. Petrie described three spectroscopic investigations at the Dominion Astrophysical Observatory, Victoria, B. C., by W. E. Harper, C. S. Beals and himself. A. H. Joy gave a summary of the behavior of variable stars of intermediate periods, which he divided into two distinct groups with periods of 88 and 111 days. The members of the first group usually have a G-type spectrum which changes considerably between minimum and maximum brightness, while the second group has a spectrum of class M which shows little change.

The absorption lines of neon, usually rather faint in stellar spectra, are very strong in Upsilon Sagitarii, as Paul W. Merrill showed, which must be due to a high neon content of this star. N. U. Mayall described the occurrence of emission lines of ionized oxygen in the spectra of a great number of extragalactic nebulae. Roscoe F. Sanford reported on observation of interstellar lines of sodium and calcium in the spectra of various stars. G. E. Kron reported on an extremely accurate photoelectric determination of the color of an eclipsing variable star.

Modifications of the Schmidt camera were discussed by W. H. Christie and Franklin B. Wright, an amateur astronomer. Sophia H. Levy described a determination of mean elements and perturbations by the Berkeley Tables for four minor planets, while Damon M. Beard gave a new orbit method, which he had applied to the recently discovered eleventh satellite of Jupiter.

W. F. Meyer, A. H. Joy and Gerard F. W. Mulders presided at the various sessions. Astronomers and physicists met informally at a joint dinner on Thursday evening, June 29, while an excursion to the Lick Observatory took place on Friday, June 30.

Association of Pacific Coast Geographers

(Report by H. F. Raup)

The fifth annual meeting of the Association of Pacific Coast Geographers was held on Thursday and Friday, June 29 and 30. The first speaker to be introduced was John E. Kesseli, with a paper entitled, "The Origin of the Valley of June and Silver Lakes, Mono County, California." In his paper, Mr. Kesseli evaluated the several factors which have been responsible for the formation of the valley and the lakes. The second speaker, Walter A. Hackler, also dealt with physical aspects of the landscape. He showed many views of the widely publicized landslip near Sargent, California, and discussed the conditions under which the landslide occurred. J. O. M. Broek then gave a presentation of the demography of the California counties, with special emphasis placed upon the reasons for the decline of population and changes in economy of residents of the northern Coast Range counties. The present and past use of the North Branch of the Susquehanna River as a trans-Appalachian route of travel was discussed by H. F. Raup.

The afternoon session of June 28 began with an historical study of eighteenth and nineteenth century American geographers and their publications, by James F. Chamberlain. This was followed by a paper by Eliot G. Mears, "Some Locational Problems in British Industry," in which he treated of recent changes responsible for the location of British industry, in comparison with the traditional location factors such as fuel supply, markets, etc. Helen M. Strong, speaking as a guest of the association, gave an informal talk on the relationship between land use and geographical conditions in widely separated parts of the United States. She was followed by Willis H. Miller, who spoke on "Geography and State Planning," with special emphasis on California planning. The final paper of the session was presented by George C. Kimber, in which he advocated a wider use of geography in determining the political wishes and views of the people under a democratic form of government.

The annual dinner was held on June 29 with members present from many parts of the Pacific Coast, and one introduced guest, Dr. Pakstas, from Lithuania. The 1939–1940 officers, recently elected, were announced: *President,* Peveril Meigs, 3rd, of Chico State College; *Vice-President,* Forrest Shreve, of the Carnegie Institution Desert Laboratory, Tucson; *Secretary-Treasurer,* Frances M. Earle, University of Washington; *Editor,* Otis Freeman, Eastern Washington School of Education, Cheney. The address of the evening was given by the retiring president, John B. Leighly, of the University of California. His topic, "The Historical Background of Carl Ritter's Geographic Theory," was in part concerned with the relationship between the ideas of Ritter and Pestalozzi.

The concluding meeting on Friday, June 30, was addressed by J. W. Hoover, who showed many views of the terraced hills of southern Arizona, the "Trincheras de Cerros." Howard H. Martin followed with an illustrated talk on the Kabyles of Algeria, a people living under conditions of isolation in a mountain environment. Frances M. Earle described conditions of health among the white residents of tropical Queensland, where she found disease no longer a deterrent to occupation of this tropical region by white men. Margaret Carstairs gave the concluding paper, "The Intensification of Agriculture in Subtropical Japan," in which she described the unusually intensive cropping of fields on the southern islands of the archipelago. The meetings concluded with the annual business session of the association.

American Society of Ichthyologists and Herpetologists, Western Division

(Report by Margaret Storey)

Two regular sessions were held on Wednesday, June 28, at which twelve papers were presented: "Problems in the Classification of Some California Fresh-Water Fishes," Leo Shapovalov; "Preliminary Studies of the Denning of the Desert Tortoise, *Gopherus agassizii*," A. M. Woodbury and Ross Hardy; "Darwinism in Contemporary Social Evolution," Paul D. R. Rüthling; "Specimen Species and Real Species," G. F. Ferris; "The Species of *Triturus* in British Columbia," Gertrude Smith Watney; "Observations on the Philippine Sea Snakes," A. W. Herre; "Notes on Metabolic

Levels of *Dipsosaurus dorsalis* (Crested Lizard) and *Sceloporus occidentalis* (Western Blue-Bellied Lizard) over a Period of Five Months under Temperature Control," F. M. Baldwin and P. W. Eberle; "Some Notes on the Physiology of Warm-Spring Fishes," F. B. Sumner; "Reproductive Cycles in the Sagebrush Lizard, *Sceloporus g. graciosus*," A. M. Woodbury and Marian Woodbury; "Observations on the Rate of Development of the Pacific Dogfish, *Squalus suckleyi*," L. E. Griffin; "Remarks on the Systematics of California Skinks," T. L. Rodgers and H. S. Fitch; and "The Herpetological Collections of the Stanford Natural History Museum," G. S. Myers. A collection of live herpetological specimens was on display at the Natural History Museum on Thursday afternoon. At the business meeting on Wednesday the following were elected to office for the coming year: *President,* Wilbert McLeod Chapman, Seattle, Washington; *Vice-President,* Tracy I. Storer, Davis, California; *Secretary-Treasurer,* Margaret Storey, Stanford University. Attendance at the various sessions ranged from 45 to 150.

The symposium "Dams and the Problem of Migratory Fishes" was presented on Thursday morning jointly with the Western Society of Naturalists. For this first authoritative summary of a timely and important problem in conservation the invited speakers included the men directly responsible for the fish-ways and fish-conservation measures at the great new dams on the West Coast. Dr. F. B. Sumner, president, introduced the following speakers: Willis H. Rich, of Stanford University and director of research, Fish Commission of Oregon, Portland, "Fishery Problems Raised by the Development of Water Resources"; Harlan B. Holmes, U. S. Engineers Corps, Portland, "The Passage of Fish at Bonneville Dam"; Wilbert M. Chapman, of the Washington State Department of Fisheries, Seattle, "Fish Problems Connected with the Grand Coulee Dam"; Harry A. Hanson, U. S. Bureau of Reclamation, Stanford University, "The Sacramento River Salmon-Salvage Problem"; and Alan C. Taft, chief of the Bureau of Fish Conservation, California State Division of Fish and Game, "Summary of the Present Status of Dams versus Migratory Fishes on the Pacific Coast, with Especial Reference to Problems in California." An interesting discussion followed, which was recorded, and a resolution was unanimously passed that before starting construction, surveys of the fisheries resources be made by qualified experts, to parallel engineering surveys, over a minimum period of five years, or sufficient to cover the life cycles of all economically important fishes concerned. Publication is planned for the entire symposium, including the discussion and resolution. Those desiring further information may write to Professor George S. Myers, Natural History Museum, Stanford University, California.

American Association of Economic Entomologists, Pacific Slope Branch

(Report by Roy E. Campbell)

The twenty-fourth annual meeting of the Pacific Slope Branch was undoubtedly the best one held so far, not only in attendance, which exceeded 200, but in the program. Almost every phase of entomology was covered, including experimental, taxonomy, teaching and demonstration. Tuesday morning included papers on new fumigants, hop insects, tomato worms, the pea aphid and the honey bee. Tuesday afternoon topics were fumigation and citrus scales, the addition of toxicants to oil sprays and recent progress in the control of other citrus pests. A motion picture was shown depicting the development and progress in fog spraying.

What was probably the outstanding feature of the meeting was the demonstration of spraying and dusting equipment Wednesday morning. At least a dozen commercial companies exhibited equipment, from small hand dusters and sprayers for backyard use to large high-powered machines mounted on trucks capable of reaching the tops of trees 150 feet high and covering orchards at the rate of 10 acres per hour. Fog and dust sprayers were also demonstrated as well as fumigating apparatus. The demonstration was attended by members of several other societies as well as the entomologists. The demonstration was followed by several technical papers on spraying, taxonomy and thrips.

On Wednesday afternoon papers on attrahents and repellents were given, together with several on forest insect problems. A sound picture on the production and use of sulfur was followed by one on the control of live-stock parasites. Thursday morning's session was devoted to papers on a variety of topics, including filbert and walnut insects, design of field plots, dried fruit insects, grasshoppers, insects for classroom use and a new alfalfa weevil. The final session was held in Golden Gate Park, San Francisco, jointly with the Pacific Coast Entomological Society.

Another notable feature of the meeting was the extensive exhibits of chemicals used as insecticides, mounts of injurious insects; insects, manuals and apparatus for classroom use; models of cages, dusters and field and laboratory apparatus used in insect studies. Officers elected were: *Chairman,* B. G. Thompson, Oregon State College; *Secretary-Treasurer,* Roy E. Campbell, Alhambra, California.

Botanical Society of America, Pacific Section

(Report by Ira L. Wiggins)

The Botanical Society of America, Pacific Section, held three general sessions, with an average attendance of fifty-five, at which thirty papers were presented. The standard of the papers was high, with particu-

larly good ones on anatomy and morphology, cytogenetics, marine algology, mycology and experimental taxonomy. D. M. Crooks described a "Translongitome" with which it is possible to cut transections and longisections, alternately, from the same block of material, both types of sections appearing in the same ribbon. G. L. Stebbins, Jr., and Lotti Steinitz reported that mitosis in *Hordeum* seedlings is inhibited under anaerobic conditions; H. S. Reed described the cytological effects of the little leaf disease; Eubanks Carsner reported that flowering of sugar beets is increased by shading of the soil or by early planting; and J. V. Harvey reported the discovery of several new watermolds.

Three symposia were held. One, a joint session with the Ecological Society of America, Western Section, dealt with "Recent Contributions of Botany and Ecology to Society" and was ably presented by E. B. Babcock, Tracy I. Storer, E. P. Meinecke and H. L. Shantz. At a joint symposium with the Western Section of the American Society of Plant Physiologists the views of two schools of thought on "Translocation of Solutes in Plants" were presented and excited brisk discussion. The third symposium centered about the opportunities for botanical research in western North America. Papers by five speakers indicated that many such opportunities still exist.

On Friday, June 30, a luncheon of the American Society of Plant Taxonomists was followed by the final session, during which ten taxonomic papers were read. D. D. Keck and J. Clausen described recent results obtained in experimental taxonomy. H. F. Copeland discussed some communications opposing and others supporting his recent proposal to make four distinct kingdoms of the old animal and plant kingdoms. Opinion was about equally divided between support and opposition.

A joint field trip to Año Nuevo Point was made by twenty-four ecologists and botanists on Saturday, July 1. Much interest was shown in the partially consolidated, unpetrified plant material exposed along the beach and in the vegetation occurring on and among the dunes.

At a brief business meeting George B. Rigg and C. Leo Hitchcock, of the University of Washington, Seattle, were elected to serve as president and councilor, respectively, during the ensuing year.

American Chemical Society, Pacific Intersectional Division

(Report by F. O. Koenig)

The session on Wednesday morning, June 28, opened with a series of four papers, chiefly by collaborators of Dr. Pauling, on molecular structure as determined by the diffraction of x-rays and of electrons. Of particular interest because of its bearing on the exact theory of protein structure at present being striven for on many fronts, was the conclusion of Dr. R. B. Corey regarding interatomic distances in proteins: from the complete crystal structure analysis of glycine and of diketo-piperazine it is probable that these distances are: C–C, 154° A; αC–N, 1.40° A; keto C–N, 1.33° A; C–O, 1.25° A. The four further papers of Wednesday morning dealt respectively with complex formation by hemoglobin derivatives (2 papers), the reduction of nitrobenzene by metals and the valence states of osmium.

The Wednesday afternoon session was devoted to two photochemical papers by Dr. Leighton and collaborators, four thermochemical papers by Dr. Parks and collaborators, a paper on liver proteins and a paper on the theory of diffusion.

On Thursday morning there were read first six papers by collaborators of Dr. McBain, dealing with the adsorption, the phase rule diagrams and the hydrolysis of various soaps. These were followed by a paper on the theory of strong electrolytes and one on the theory of cells with liquid-liquid junctions.

The session of Thursday afternoon began with a historical paper on Alexander Butlerov. This was followed by seven papers dealing respectively with the introduction of substituted amino groups into the aromatic nucleus, the quantitative determination of bismuth in certain antisyphilitic agents, the flotation of galena in the presence of xanthates, the oxidation of pigments in freshly killed leaves, the rate of salt infiltration into chilled fish, allylic rearrangements and the bioassay of riboflavin.

American Society of Plant Physiologists, Western Section

(Report by A. S. Crafts)

The program of the Western Section this year consisted of three symposia, three half-day sessions for submitted papers and the annual dinner.

A joint symposium with the Western Society of Soil Science on Wednesday morning, June 28, considered problems of nutrient availability in soils. Professor Burd's discussion of the mechanics of phosphate retention by soils and the description of the process of contact exchange between plant roots and soil colloids by Hans Jenny were outstanding contributions.

While the symposium with the Botanical Society on "Translocation of Solutes in Plants" was marred by the absence of T. G. Mason and O. F. Curtis, an interesting presentation of the anatomy of vascular tissues by Dr. Esau and descriptions of virus, auxin and radioactive isotope movement in plants provided an interesting program. A discussion of the mechanics of organic solute movement concluded the session.

The symposium on "Growth," which started with a description of growth in meristems by Dr. A. S. Foster

and considered the nutritional factors involved and the role of vitamin B and auxin, was of broad interest and attracted a good audience.

The Wednesday afternoon program of submitted papers concerned soil-plant relations as affected by water and nutrients. The physiology of yeasts, problems of plant biochemistry and the response of plants to x-rays and radioactive elements were topics considered on Thursday morning. Studies on phloem exudate from grape were also described. The Friday afternoon session presented some papers of outstanding interest on mineral nutrition, salt flux and accumulation and growth factor requirements of roots.

Officers for the coming year, as announced at the dinner on Friday evening, are: *Chairman,* W. M. Atwood; *Vice-Chairman,* A. S. Crafts; and *Secretary,* J. van Overbeek.

An extremely interesting trip through the greenhouses and laboratories of the Division of Plant Nutrition at Berkeley, personally conducted by Professor D. R. Hoagland and members of his staff, was enjoyed by a number of visiting plant physiologists on Saturday morning.

American Phytopathological Society, Pacific Division

(Report by L. D. Leach)

The meetings of the Pacific Division of the American Phytopathological Society were featured by a larger attendance and greater diversity of program than for several years. Thirty-two papers reporting research projects were presented during four half-day sessions. Of the eight papers on virus diseases, the presentation of evidence of the production of curly-top virus antibodies or antibody-like substances in Turkish tobacco by J. M. Wallace created the most discussion. Other papers of general interest were those of C. E. Yarwood on attempts at the *in vitro* culture of certain powdery and downy mildews and of J. T. Barrett on the occurrence of overwintering mycelium of downy mildew in the California wild grape. A group of papers on control of *Armillaria* by soil fumigants was presented by H. E. Thomas, L. O. Lawyer and P. D. Caldis. Prevention of apothecial formation of *Sclerotinia fructicola* by soil treatments was reported by G. A. Huber.

Thursday morning was devoted to a symposium on teaching of plant pathology. Certain phases of the problem were discussed by W. W. Robbins, J. T. Barrett, W. B. Hewitt, H. R. Stanford and T. E. Rawlins.

A field trip of unusual interest, consisting of visits to several greenhouses and commercial plantings of ornamentals between Palo Alto and San Francisco and a tour through one of the large estates occupied all of Friday.

Officers of the society for the ensuing year are as follows: *President,* B. F. Dana, U. S. Department of Agriculture, Corvallis, Oregon; *Vice-President,* T. E. Rawlins, University of California; *Secretary-Treasurer,* L. D. Leach, University of California, Davis; *Councilor,* E. Carsner, U. S. Department of Agriculture, Riverside.

Western Society of Naturalists

No Report Received

Ecological Society of America, Western Section

(Report by H. de Forest)

The society cooperated with the Botanical Society of America in organizing a symposium on "Recent Contributions of Botany and Ecology to Society," held on Wednesday, June 28. T. I. Storer and H. L. Shantz spoke for the Ecological Society on animal and plant ecology, respectively.

On Thursday, June 29, a session for the presentation of papers occurred. Eight papers were given, two of these being invitational, by R. W. Chaney on Tertiary forests and by A. H. Hutchinson on a method of polygonal graphing of ecological data containing several variables. H. P. Hansen read a paper on ring-growth and dominance in a spruce-fir forest, and G. A. Pearson one on growth in southwestern pine forests. E. Fritz gave an interesting account of anomalous growth rings in redwood. L. C. Cole described an electrical apparatus for measuring several environmental factors. The Hutchinson and Cole work held as much of interest for zoologists as for botanists. The more distinctively zoological papers, which were placed in the latter half of the program because of an unexpected A. A. A. S. botanical excursion to the Carnegie Institution Laboratory of Plant Biology in the later afternoon, were by W. H. Rich on the influence of environment on salmon migration and by C. T. Vorhies on the habitat and shelter preferences of *Neotoma albigula.* Both of these called forth interesting discussion.

The society participated in the Biologists' Dinner of Wednesday evening, June 28. On Saturday, July 1, an enjoyable joint field excursion took place with the Botanical Society of America. During the day redwood forests, streamsides, chaparral and other scrubs and the coastal sand dunes of Año Nuevo Point were visited. The plant life was commented on by L. R. Abrams and I. L. Wiggins, of Stanford University.

Society for Experimental Biology and Medicine

(Report by Charles Weiss)

The Pacific Coast and the Southern California branches of the Society for Experimental Biology and Medicine met jointly on June 30, 1939. A total of 19 papers was presented and also an invited address on

vitamin K by H. J. Almquist, of the University of California, Berkeley.

P. J. Hanzlik, W. C. Cutting and G. B. Robson reported on the gastro-intestinal absorption of insulin in animals. Astringents, simple alcohols, poly-alcohols, detergents, antiseptic dyes, local anesthetics and agents which increase permeability favor absorption in animals. Results in man are unsatisfactory.

James B. McNaught, R. R. Beard and F. DeEds reported on the efficacy of phenothiazine in experimental trichinosis. R. H. Wilson and F. DeEds concluded that the continued feeding of cadmium-containing diets produces cardiac hypertrophy traceable to the anemia produced.

E. F. Cannon, S. P. Lucia and E. H. Benson, of the University of California Medical School, conclude that the difference induced in the circulation time after exercise is not significant as a test for cardiac efficiency.

N. S. West and R. H. Vaughn, of the University of California, reported that coliform organisms of the genus *Citrobacter* might be responsible for gassy deterioration of olives.

Ira A. Manville, of the University of Oregon, Portland, reported that sorbitol is well tolerated by diabetic patients and provides a good source of energy; it also favors the deposition of glycogen in the liver. F. J. Reithel, of the University of Oregon, Portland, reported that the presence of food in the stomach decreases the concentrtaion of alcohol after the ingestion of intoxicating liquors. Effective foods are sugar, apple juice, milk, bread, egg albumen, butter, cream and amino acids.

H. S. Reed, Department of Botany, University of California, read a report sent by Dr. J. Dufrenoy, of Bordeaux, France. Certain springs which had been used since Roman times to cure sick people were found to favor the proliferation of willow cuttings. These are the springs of St. Roche and Tambour in the Pyrenees Mountains.

WESTERN SOCIETY OF SOIL SCIENCE

(Report by L. T. Kardos)

The Western Society of Soil Science held five half-day sessions at which were submitted 33 papers. The attendance ranged from fifty to seventy persons.

The papers on Monday and Tuesday were devoted largely to problems of land classification, land utilization, evaluation of soils, soil conservation, drainage, erosion, soil permeability, soil moisture, bound water in soils, flocculation of soil, fixation of arsenic by soils, organic matter in soils, base exchange capacity and bacterial activity in soils.

On Wednesday morning a session was held jointly with the American Society of Plant Physiologists in which four papers were presented in a symposium on the "Availability of Nutrients in Soils to Plants." The speakers were W. T. McGeorge, of the University of Arizona; John S. Burd, of the University of California in Berkeley; H. D. Chapman, of the Citrus Experiment Station in Riverside, and Hans Jenny, of the University of California in Berkeley.

The following officers were elected for the ensuing year: *President,* W. T. McGeorge, University of Arizona, Tucson; *Vice-president,* G. B. Bodman, University of California, Berkeley; *Secretary-Treasurer,* L. T. Kardos, State College of Washington, Pullman; *Council Representative,* O. C. Magistad, Regional Salinity Laboratory, Riverside.

CONCURRENT MEETINGS OF OTHER ORGANIZATIONS

AMERICAN ASSOCIATION OF PHYSICS TEACHERS

(Report by Paul Kirkpatrick)

The Wednesday morning session was devoted to the presentation of brief contributed reports, relative chiefly to apparatus useful in the teaching of physics but containing also reports of historical and theoretical interest. At the luncheon which followed, Vice-President A. A. Knowlton spoke briefly of the general affairs of the association. During Wednesday afternoon apparatus used in elementary and upper-division physics courses in Stanford was on display in the laboratories. This equipment is mainly of local design and construction.

The evening meeting of the same day consisted of three invited papers. V. F. Lenzen discussed "The Operational Theory in Elementary Physics," criticizing constructively a number of the concepts and definitions regularly presented in the teaching of general physics. "Historical View-Point and Allusion in Physics Teaching" was the subject of a paper by E. C. Watson, which the author illustrated by slides made from materials in his private collection of historical matter related to physics and technology. R. D. Richtmyer showed a series of related absolute experiments for the electrical-measurements laboratory, performing the manipulations and carrying out numerical results in the course of his presentation.

AMERICAN SOCIETY FOR HORTICULTURAL SCIENCE, WESTERN SECTION

(Report by W. W. Aldrich)

In the case of previously nitrogen-deficient grapefruit trees near Yuma, Arizona, the maintenance of a high nitrogen level (as indicated by nitrogen content of leaves) during the spring and summer resulted in fruit of a coarser texture and greener color that fall.—W. E. Martin, University of Arizona.

The sugar prune, which normally sets a heavy crop one year and then fails to blossom the next year,

blossomed heavily the following year when entire trees or limbs two inches or more in diameter were completely deflorated or defruited within 14 to 30 days after full bloom. Strangely, either the upper or lower half, if completely deflorated, would differentiate with large numbers of blossom buds, while the undeflorated half was apparently not affected.—L. D. Davis, University of California.

As a means of covering emasculated blossoms, to keep out insects and windblown pollen, a web of rubber cement can be spun by a small electric fan, with attachment for feeding cement at constant pressure. Web has thus far shown no deleterious effects to pollen or to pistil.—J. R. King, University of California.

In a ten-year study of rootstocks for the Satsuma orange, the Morton citrange showed promise of permitting as good tree growth and yield as the sweet orange. Trifoliate stock was definitely inferior.—H. J. Webber and L. D. Batchelor, University of California.

SCIENTIFIC EVENTS

EXHIBITS AT THE BRITISH NATURAL HISTORY MUSEUM

RECENT additions to the Natural History Museum, South Kensington, include a number of mounted heads and skulls of hoofed mammals from Northern Rhodesia, an area from which the museum has hitherto not possessed much material of this kind. They were collected, chiefly at Mpika, by the late F. H. Medland, and have been given by Mrs. Medland. Among them are some very fine sable and roan antelope heads which are of special interest as representing transition stages from the types found in South Africa to the more northerly forms of Tanganyika Territory and Kenya Colony.

Two large collections of South American mammals, one from Dutch Guiana and the other from Ecuador, have been purchased. The latter contains a series of specimens representing a remarkable genus of Diprotodont marsupials (*i.e.*, marsupials having the kangaroo type of dentition), *Caenolestes*, one of the genera of opossum mice.

A series of specimens of "Darwin Glass" from Mount Darwin, Tasmania, collected by the late Hartwell Conder, has been given by his widow. This is a silica glass of a pale olive color, thousands of tons of which are found, in the form of small rounded or rod-like pieces, over an area of 60 square miles. It is thought to have been formed by the heat caused by the impact of a large meteorite.

A British mineral of which good crystals are very rare is withamite, a pink variety of epidote, an iron aluminium silicate which is usually green. The type-locality is Glencoe, and some excellent specimens from there have now been presented to the museum by Mr. W. G. Myers, a local A.A. scout, who found them when the new road was cut through the lava in which they occur. The Mineral Department has also acquired a large rough crystal of microcline feldspar from Norway, measuring 14 inches by 12 inches by 10 inches and weighing about 100 pounds.

Two new exhibits have been put on view in the central hall. One is devoted to the Coelacanth fish, lately discovered off the South African coast, and belonging to a type which was supposed to have been extinct for 50,000,000 years. The fish has been named *Latimeria Chalumnæ* by Dr. J. L. B. Smith, of Grahamstown, who first recognized its nature and importance. A life-size photograph is shown, together with models illustrating the close similarity of *Latimeria* to its fossil relatives.

The second exhibit illustrates the method used by the museum to reconstruct extinct animals (the particular beast chosen is the large amphibian *Cyclotosaurus* from the Triassic ironstone of New South Wales) from the impressions of their skeletons in rock.

THE BYRD ANTARCTIC EXPEDITION

A CONFERENCE was held in Washington on July 24 under the auspices of the National Academy of Sciences and the National Research Council concerning scientific arrangements for the coming Antarctic Expedition.

According to press reports, thirty-two scientific men from twenty government agencies and representatives of institutions of learning and research discussed the scientific program of the expedition with Rear Admiral Byrd, commander. Dr. Isaiah Bowman, president of the Johns Hopkins University, presided. He was assisted by Dr. Henry B. Bigelow, director of the Oceanographic Institution at Woods Hole, Mass.

Plans for meteorological observations and for the mapping of a region some 5,000,000 miles in extent, 3,000,000 miles of which is still to be explored, were discussed at length. The desirability of making arrangements to insure the continuation of these observations over a series of years was also taken up.

It is planned to establish for the expedition three bases, one at Little America, another about 1,400 miles to the eastward, and a third between the two, with twenty-two men at each base, though not continuously. They will come and go as specialists replacing each other to engage in their respective activities.

Members of the expedition, which it is expected will start in October, will include: Dr. F. Alton Wade,

geologist, Miami University; Dr. Thomas Poulter, physicist, director of the Research Foundation of the Armour Institute of Technology; Richard Black, engineer surveyor, who is attached to the Division of Territories and Island Possessions of the Department of the Interior, and Paul Sipel, who was the Boy Scout member of the last Byrd Expedition and who since has taken his Ph.D. at Clark University.

PRELIMINARY PROGRAM OF THE DUNDEE MEETING OF THE BRITISH ASSOCIATION

ACCORDING to the preliminary program of the meeting of the British Association for the Advancement of Science to be held at Dundee, under the presidency of Sir Albert Seward, from August 30 to September 6, the following are among the principal subjects announced for presentation:

WEDNESDAY, AUGUST 30

Presidential Address by Sir Albert Seward, on "The Western Isles through the Mists of Ages."

THURSDAY, AUGUST 31

Presidential Addresses in the Sections:

A—R. S. Whipple, on "Instruments in Science and Industry."

B—Professor E. K. Rideal, on "Film Reactions as a New Approach to Biology."

D—Professor J. Ritchie, on "Perspectives in Evolution."

G—H. E. Wimperis, on "The Future of Flight."

L—Dr. A. P. M. Fleming, on "Education for Industry."

M—Sir Thomas Middleton, on "Practice with Science. The Farmer's Position and the Scientific Worker's Program."

Discussions, etc., in the Sections:

A—"Television."

B, I—"Tissue Respiration."

C—"Local Geology."

E—"A National Atlas" (with speakers from Sections C, D, F, H, K, M).

G—"Problems of Transatlantic Aviation."

L—"Education as a Preparation for Industry."

Division for the Social and International Relations of Science—Papers and discussion on coordination of scientific research, on population and other topics.

FRIDAY, SEPTEMBER 1

Presidential Addresses in the Sections:

E—A. Stevens, on a subject to be announced.

H—Professor W. E. Le Gros Clark, on "The Scope and Limitations of Physical Anthropology."

J—R. J. Bartlett, on "Measurement in Psychology."

K—Professor D. Thoday, on "The Interpretation of Plant Structure."

Discussions, etc., in the Sections:

A, B—"Applications of Artificial Radio-Elements."

C—"Raised Beaches of Forth and Tay."

D—"The Natural History of Salmon and Trout: Exhibition of Biological Films."

F—"Scottish Problems."

G—"Air Conditioning."

I—"The Problem of Pain" (whole-day session, at St. Andrews).

L—"Educational Facilities in Industry."

M—"Agricultural Education."

Discussion on Jute (under the auspices of appropriate Sections).

Conference of Delegates of Corresponding Societies.—Presidential Address by Professor H. L. Hawkins, on "Local Scientific Societies and the Community"; papers and discussion.

SUNDAY, SEPTEMBER 3

Division for the Social and International Relations of Science.—Address by Sir Richard Gregory, on "Science and Social Ethics."

MONDAY, SEPTEMBER 4

Sectional Presidential Address:

C—Professor H. H. Read, on "Metamorphism and Igneous Activity."

Discussions, etc., in the Sections:

A—"Problems of High-speed Flight."

A—"Surface Temperature of Stars."

B—"Light Alloys."

D—"Problems of Freshwater Biology."

H, I—"Nutrition and Physique."

L—"Educational Research in Scotland."

M—"Grass Conservation."

Conference of Delegates of Corresponding Societies.—Papers and discussion.

TUESDAY, SEPTEMBER 5

Presidential Addresses in the Sections:

F—Professor H. O. Meredith, on a subject to be announced.

I—Professor D. Burns, on "The Assessment of Physical Fitness."

Discussions, etc., in the Sections:

A—"High Temperature Problems."

A—"Solar and Terrestrial Relationships."

B—"Intra-molecular Changes."

C—"Old Red Sandstone-Carboniferous Boundary."

H—"Teaching of Anthropology."

I—"The Assessment of Physical Fitness."

L—"Discussion on Spens Report."

M—"Seed Potato Growing."

Discussion on Jute (continued from Friday).

Evening Address by Dr. Isaiah Bowman.

WEDNESDAY, SEPTEMBER 6

Division for the Social and International Relations of Science. Discussion on Nutrition.

THE BOSTON MEETING OF THE AMERICAN CHEMICAL SOCIETY

ALL the eighteen professional divisions of the Amer-

ican Chemical Society will meet in Boston from September 11 to 15 in connection with its ninety-eighth convention. Numerous symposia will supplement the regular sessions.

The divisions and their chairmen are: Agricultural and Food, Dr. Roy C. Newton, of Swift and Company, Chicago; Biological, Dr. Joseph J. Pfiffner, of Parke, Davis and Company, Detroit; Cellulose, Professor George L. Clark, of the University of Illinois; Chemical Education, Martin V. McGill, of Lorain High School, Lorain, Ohio; Colloid, Professor Lloyd H. Reyerson, of the University of Minnesota; Fertilizer, Egbert W. Magruder, of the F. S. Royster Guano Company, Norfolk, Va.; Gas and Fuel, Dr. Frank H. Reed, of the Illinois Geological Survey; History of Chemistry, Professor Tenney L. Davis, of Massachusetts Institute of Technology; Industrial and Engineering, Dr. Walter L. Badger, of the Dow Chemical Company, Ann Arbor, Mich.; Medicinal, Professor Walter H. Hartung, of the University of Maryland; Microchemistry, Lawrence T. Hallett, Eastman Kodak Company, Rochester, N. Y.; Organic, Professor Werner E. Bachmann, of the University of Michigan; Paint and Varnish, Professor William H. Gardner, of the Polytechnic Institute, Brooklyn, N. Y.; Petroleum, Dr. Per K. Frolich, of the Standard Oil Development Company, Elizabeth, N. J.; Physical and Inorganic Chemistry, Professor George Scatchard, of Massachusetts Institute of Technology; Rubber, Dr. G. K. Hinshaw, of the Goodyear Tire and Rubber Company, Akron, Ohio; Sugar Chemistry and Technology, A. R. Nees, of the Great Western Sugar Company, Denver, Colo.; Water, Sewage and Sanitation, Professor Alvin P. Black, of the University of Florida.

The divisions will hold symposia as follows:

The Division of Agricultural and Food Chemistry is sponsoring a symposium on Nitrogen-Free Extracts, with Dr. C. A. Browne, of the U. S. Bureau of Chemistry and Soils, Washington, D. C., in charge, and another on Plant Hormones. Together with the Division of Medicinal Chemistry, the food chemists will cooperate with the Biological Division in a program on Vitamins and Nutrition. Papers on other agricultural and food topics will also be heard.

The Division of Biological Chemistry will devote a day to a symposium on Methods in Protein Chemistry. It will also join the Medicinal Division in a symposium on Sterols and Related Compounds. General papers in the field of biological chemistry will be given at other sessions. The Cellulose Division will hear a variety of general papers.

Dr. Mary L. Sherrill, of Mount Holyoke College, will be chairman of a symposium on the Training and Opportunities for Women in Chemistry to be held by the Division of Chemical Education. The Colloid Division will participate in a symposium on X-Ray Studies of Substances of High Molecular Weight, with Dr. Maurice L. Huggins, of the Eastman Kodak Company, presiding. The Fertilizer Division will have a program of general papers in three sessions.

A symposium on the Combustion of Solid Fuels under the chairmanship of Martin A. Mayers, of the Coal Research Laboratory of the Carnegie Institute of Technology, will be sponsored by the Gas and Fuel Division. A comprehensive session on Industrial Wastes is planned by the Division of Industrial and Engineering Chemistry and Water, Sewage and Sanitation Chemistry. Dr. Walter A. Schmidt, president of the Western Precipitation Company, will be chairman.

A third Unit-Process Symposium will be held by the Industrial and Engineering Division, with Professor R. Norris Shreve, of Purdue University, presiding. A symposium on Resins and Plastics from Hydrocarbons is planned by the Petroleum, Paint and Varnish, and Rubber Divisions.

The Division of Physical and Inorganic Chemistry, of which Professor Harold C. Urey, of Columbia University, is secretary, will have a program of a hundred and thirteen papers. Professor F. G. Keyes, of the Massachusetts Institute of Technology, will preside at a symposium on Low Temperature Research, and Professor W. C. Fernelius, of the Ohio State University, at a symposium on Compounds with Elements in Unusual States of Valence. Dr. Scatchard, Professor Charles P. Smyth, of Princeton University, and Professor Urey will be chairmen of the sessions on physical chemistry, while Professor G. Frederick Smith, of the University of Illinois, will preside at the sessions on inorganic and analytical chemistry.

A symposium on Vulcanization in addition to a special celebration of the centenary of the discovery of the vulcanization of rubber by Charles Goodyear will be sponsored by the Rubber Division. Numerous general papers on rubber chemistry are also scheduled.

RECENT DEATHS AND MEMORIALS

DR. WENDELL CLAY MANSFIELD, geologist of the U. S. Geological Survey, died suddenly on July 24 at the age of sixty-five years. His principal line of research was the late-Tertiary mollusks of the southeastern states, particularly of Florida.

DR. BURTIS BURR BREESE, who retired two years ago as head of the department of psychology at the University of Cincinnati with the title of professor emeritus, died on July 31 at the age of seventy-two years.

JOHN RITCHIE, of Malden, Mass., died on July 22 at the age of eighty-eight years. Mr. Ritchie was interested in astronomy and for many years was in charge of the collection and distribution of astronomical news from the Harvard Observatory. He also was active in conchology and in other scientific subjects.

JOHN HARVEY LOVELL, known for his work with bees, biological editor of "Cyclopedia of Bee Culture" died on August 2 at the age of seventy-eight years.

PROFESSOR ARCHIBALD YOUNG, Regius professor of

surgery in the University of Glasgow, died on July 23 at the age of sixty-five years.

THE Agricultural Experiment Station at New Haven, Conn., will include brief addresses in memory of the late station botanist, Dr. G. P. Clinton, and the state entomologist, Dr. W. E. Britton, in the Field Day exercises to be held at the station farm at Mount Carmel on August 16. Dr. Clinton died two years ago after thirty-five years of state service, and Dr. Britton, who had served the state since 1893, died last February. Immediately after luncheon Director W. L. Slate, of the station, will open a short program which will include an address by Dr. Henry G. Knight, chief of the Bureau of Chemistry and Soils, Washington, D. C. Mr. David Clarke, of Milford, will say a few words about the work of the late Dr. Clinton, and Mr. Fred S. Baker, of Cheshire, will speak about Dr. Britton. Later the new state entomologist, Dr. Roger B. Friend, and the station botanist, Dr. J. G. Horsfall, appointed early this summer, will be introduced.

To mark the two hundredth anniversary of the founding of the Swedish Royal Academy of Science, the Swedish Post Office issued a set of commemorative stamps on June 2. The designs are: 15 öre brown and 50 öre grey, with a portrait of the naturalist Linnaeus; 10 öre violet and 30 öre blue, with a portrait of the chemist Berzelius.

SCIENTIFIC NOTES AND NEWS

DR. W. L. BRAGG, Cavendish professor of experimental physics in the University of Cambridge, has been elected a corresponding member in the section of mineralogy of the Paris Academy of Sciences.

THE Royal Academy of Sciences at Rome has awarded the Cannizzaro prize for chemistry to Professor Otto Hahn, of the University of Berlin.

THE gold medal of the Society of the Medical and Natural Sciences at Jena has been awarded to Dr. Werner Heisenberg, professor of theoretical physics at the University of Leipzig.

MEDALS of the Royal Scottish Geographical Society for 1939 have been awarded as follows: the Livingstone Gold Medal to the Right Hon. Lord Hailey, for his direction of the African Research Survey under the auspices of the Royal Institute of International Affairs; the Mungo Park Medal to Dr. E. B. Worthington, for his share in the work of the African Research Survey; the Research Medal to Dr. Herbert John Fleure, professor of geography and anthropology in the University of Manchester, "for his many original contributions to geography and anthropology and his furtherance of these sciences in the British Isles."

Nature states that the Royal African Society has awarded a silver medal to the late C. F. Massy Swynnerton, formerly director of tsetse research in Tanganyika Territory.

DAVID G. THOMPSON, senior geologist, and Albert G. Fiedler, senior engineer, of the U. S. Geological Survey, were awarded at the annual convention of the American Water Works Association at Atlantic City the John M. Goodell Prize for their paper entitled "Some Problems Relating to Legal Control of Use of Ground Water." This prize was established by *The Engineering News Record* as a memorial to John M. Goodell, one-time editor of the journal and a former editor of the *Journal* of the American Water Works Association. It is awarded annually for "a notable contribution to the science or practice of water works development."

ESTELLE LACASE, a member of the Junior Academy of Science of New Orleans, has been awarded a prize consisting of a subscription to SCIENCE for one year in a recent contest based upon a written review of the contents of Volume 88 of SCIENCE.

DR. HOWARD I. YOUNG, president of the American Zinc, Lead and Smelting Company and of the American Mining Congress, was awarded the honorary degree of doctor of engineering at the commencement exercises of the School of Mines and Metallurgy of the University of Missouri.

ON commemoration day at the University of Glasgow the doctorate of laws was conferred on Sir Andrew Rae Duncan, chairman of the executive committee of the British Iron and Steel Federation; W. J. Goudie, emeritus professor of the theory and practice of heat engines, University of Glasgow; I. M. Heilbron, professor of organic chemistry, University of London; H. J. Paton, White's professor of moral philosophy, University of Oxford; F. J. M. Stratton, professor of astrophysics, University of Cambridge, and G. G. Turner, professor of surgery, University of London.

DR. GUSTAVUS AUGUSTUS EISEN, from 1893 to 1900 curator of the California Academy of Sciences, later for five years connected with the U. S. Department of Agriculture, known for his work in biology, anthropology and archeology, celebrated his ninety-second birthday on August 2.

DR. CLYDE E. KEELER, instructor in the Bussey Institution of Harvard University, has been elected a fellow of the Wistar Institute of Anatomy and Biology, Philadelphia.

DR. R. RUGGLES GATES, professor of botany at King's College, the University of London, has been appointed president of the section of cytology of the seventh International Botanical Congress for the meeting to be held at Stockholm from July 17 to 25, 1940.

HARRY W. CAVE, of the Kansas State College, has been appointed head of the department of dairy husbandry at the Oklahoma Agricultural and Mechanical College. He succeeds Earl Weaver, who resigned some time ago to accept a similar position at the Michigan State College.

DR. IVER JOHNSON, of the University of Minnesota, has been appointed professor of farm crops at the Iowa State College. He will specialize in plant breeding.

DR. ROY S. HANSLICK, of New Haven, Conn., has been appointed assistant professor of chemical engineering at Vanderbilt University.

DR. CARL L. STOTZ, visiting lecturer in geography for the last three years in the summer sessions of the University of Pittsburgh, has been elected assistant professor of geography at the university.

DR. T. V. I. STARKEY, lecturer in physics and mathematics at Rotherham College of Technology, has been appointed head of the physics department of the Technical College, Swansea, in place of Dr. E. Thomas, who has been appointed director of education for Caernarvonshire.

DR. DEAN BURK, associate professor of biochemistry at Cornell University Medical College, New York City, has been appointed senior chemist in the National Cancer Institute of the U. S. Public Health Service. He will be engaged in a study of tissue metabolism fundamental to cancer, under the auspices of a grant from the National Advisory Cancer Council made to the department of biochemistry. Collaborating in the investigations will be Dr. Fritz Lipmann, formerly fellow at the Rockefeller Institute with Dr. P. A. Levene and recently research associate with Dr. Albert Fischer and Dr. Herbert Sprince on a Parker fellowship from Harvard University.

IN the statement in regard to the reorganization of the work in zoology at Cornell University, printed in the issue of SCIENCE for July 28, those doing work in vertebrate taxonomy, ecology and anatomy should have been given as: Professor A. H. Wright, Assistant Professor W. J. Hamilton, Jr., Dr. W. C. Senning and Dr. E. C. Raney, instructors.

DR. VLADIMIR KARAPETOFF, for thirty-five years professor of electrical engineering at Cornell University, who has been made professor emeritus, will reside in Leonia, N. J., where he will engage in research and consulting work. He will next year give a course of lectures on electromagnetic waves in the new evening post-graduate school for metropolitan engineers at the Stevens Institute of Technology, Hoboken, N. J.

THE second International Congress for the Investigation of Biological Rhythm will be held at Utrecht on August 25 and 26.

THE third International Congress of Agricultural Engineering, according to *The Experiment Station Record,* will be held in Rome from September 20 to 23 at the International Institute of Agriculture. The program of the congress has been drawn up by the International Commission on Agricultural Engineering. Irrigation, drainage and land reclamation works, provisions for hygiene and buildings in rural areas, production of motive power by means of new combustible materials, standardization of tests of agricultural machinery, applications of electricity in agriculture, agricultural engineering and its social implications and scientific management in agriculture are the main subjects in the agenda. Additional information may be obtained from the Secretariat, Via Regina Elena, 86, Rome, Italy.

BEFORE the formal conferences of the fifth International Congress of Genetics at Edinburgh, there will be a gathering in London and organized visits to the plant-breeding work at Wisley and to the Galton Laboratory and various parts of the University of London. The next move will be to Cambridge, where the delegates will visit the leading research centers engaged in animal and crop-breeding work. The arrangements have been worked out in such a way as to bring scientific and practical breeders together for discussion and interchange of views. The formal congress will open at the University of Edinburgh on Wednesday, August 23, when the Russian scientist, Professor Vavilov, will deliver his presidential address. He will be followed by well-known American, Dutch and other foreign research workers. Receptions have been arranged for delegates by the City of Edinburgh, by his Majesty's Government and various organizations. The general secretary of the congress is Professor F. E. Crew, of the Institute of Animal Genetics, West Main Road, Edinburgh.

AT the ninth annual meeting of the American Malacological Union, held in the Royal Ontario Museum of Zoology in Toronto from June 20 to 23, the following executive council was elected: *Honorary Presidents:* Mrs. Ida S. Oldroyd, Stanford University; Dr. Henry A. Pilsbry, Academy of Natural Sciences, Philadelphia; and Mrs. Harold R. Robertson, Buffalo Museum of Science; *President,* Dr. H. B. Baker, Zoological Laboratory, University of Pennsylvania; *Vice-president,* Dr. Harald A. Rehder, U. S. National Museum; *Corresponding Secretary,* Norman W. Lermond, Knox

Academy of Arts and Sciences, Thomaston, Me.; *Financial Secretary,* Mrs. Harold R. Robertson, Buffalo Museum of Science; *Councillors at Large,* Dr. Myra Keen, Stanford University; Dr. Henry van der Schalie, University of Michigan Museum; Dr. H. E. Wheeler, Birmingham, Ala.; Aurela LaRocque, Canadian National Museum; *Past Presidents,* Dr. Joshua L. Baily, Jr., San Diego, Cal.; Dr. Paul Bartsch, U. S. National Museum, Washington, D. C.; William J. Clench, Museum of Comparative Zoology, Cambridge; Calvin Goodrich, University of Michigan Museum; Dr. Henry A. Pilsbry, Academy of Natural Sciences, Philadelphia; Maxwell Smith, Lantana, Fla.; Dr. Carlos de la Torre, Museo Poey, Havana. The 1940 meeting will be held in Philadelphia.

THE Museums Association of Great Britain celebrated its jubilee at the annual conference which was held at Cheltenham during the week beginning on July 2. In addition to Lord Bledisloe, who delivered the presidential address, speakers from related organizations included Lord Balniel, representing the Standing Commission on Museums and Galleries, Lord Amulree, president of the Royal Society of Arts, Dr. Arundell Esdaile, president of the Library Association, and Sir Robert Witt, chairman of the National Art-Collections Fund. Papers read during the conference included those of Lord De La Warr on "Museums and Education," and of Don Salvador de Madariaga, chairman of the International Museums Office, Paris, on "Museums and World Peace."

THE John Burroughs Association desires to get in touch with all organizations in the United States and elsewhere that have been established in honor of John Burroughs, to learn whether such groups would be interested in a yearly publication containing reports from these various units, as well as articles about John Burroughs. Communications should be addressed to Dr. Clyde Fisher, president of the association, at the American Museum of Natural History, New York City.

IT is announced by the London *Times* that the general council of the Trades Union Congress has appointed J. Hallsworth, the chairman, H. H. Elvin, E. Bevin and Sir Walter Citrine to meet representatives of the British Association to discuss the procedure of the Scientific Advisory Council which is to be jointly established. J. Marchbank has been appointed a deputy representative. The *Times* states that it is more than eighteen months since the first steps were taken to bring together members of the British Association and the Trades Union Congress. There have been informal talks, but the work of the advisory council has not yet taken shape.

THE William R. Warner and Company, Inc., New York City, announces the establishment of the following research fellowships under the Warner Institute for Therapeutic Research, for the year beginning July 1, 1939: At Columbia University, College of Physicians and Surgeons; under Professor James W. Jobling, department of pathology: a post-doctorate fellowship to Dr. Henry S. Simms, for the continuation of his work on arteriosclerosis; at the University of Maryland, School of Pharmacy; under Professor Walter H. Hartung, department of pharmaceutical chemistry: (1) a post-doctorate fellowship to Dr. Melvin F. W. Dunker, for work in organic synthesis; (2) a post-graduate fellowship to George P. Hager, for work in organic synthesis; (4) a post-graduate fellowship to Kenneth E. Hamlin, for work in organic synthesis; at the Warner Institute for Therapeutic Research, under Dr. Marvin R. Thompson, director: (1) a post-doctorate fellowship to Dr. P. P. Zapponi, for studies in physical chemistry.

A COLLECTION of 8,257 herbarium sheets, consisting of plants from England, Western Continental Europe, northeastern United States and adjacent sections of Canada, has been presented to the New York Botanical Garden by Mrs. T. W. Edmondson. They are the collections made by her husband during vacations over many years. Dr. Edmondson was professor of mathematics and physics and, before his death last autumn, professor emeritus at New York University. The garden has also acquired about a hundred volumes of botanical books from Dr. Edmondson's library.

L. J. BRASS, botanist of the Archbold Expedition to Dutch New Guinea, returned to Brisbane by the flying boat *Coogee* on June 28. The expedition was led and sponsored by Richard Archbold in the scientific interests of the American Museum of Natural History. The principal method of transport was by the flying boat *Guba.* The personnel, equipment and stores of the expedition were flown from sea level to Lake Habbema at 11,000 feet in the mountains. The botanical collections made by Mr. Brass include over 5,000 numbers. These were mostly obtained from regions above 3,000 feet. It is understood that these specimens will be allocated for determination to various American and European specialists by Professor E. D. Merrill, administrator of the botanical collections of Harvard University. Another result of the work is a collection of a hundred and fifty 10×8-inch negatives of landscapes typical of the regions worked over by the expedition. Mr. Brass is leaving Brisbane this month for New York, where he will complete his work upon some of the collections.

THE first International Exhibition for Polar Exploration will be held at Bergen in 1940. Dr. Gran Bögh has been appointed Commissioner-General by the Norwegian Government. In connection with the exhibition an international conference of Polar explorers is being arranged.

A LARGE new exhibition hall, devoted to comprehensive archeological and ethnological collections from the lands of Budda and other Oriental countries, has been opened at the Field Museum of Natural History. The museum already had important collections of Chinese and Tibetan material. The opening of the new hall, which is devoted to Korea, Siam, Siberia, India, Burma, Ceylon, the Ainu of Yezo, and the Andaman and Nicobar groups of islands in the Pacific, rounds out the representation of life in the Far East. The hall contains hundreds of objects, large and small, varied in character, including pieces remarkable for their beauty, for their ingenuity and for their extreme oddity. They have been gathered over a period of many years and come from various sources. One of the most striking features in the hall represents the ancient Siamese ancestors of the modern motion pictures—that is, the figures used in shadow plays. Mounted on glass and illuminated from behind, these are displayed much as they would appear in performances given in their place of origin.

ACCORDING to the Paris correspondent of the *Journal* of the American Medical Association, the drop in the birth rate in France as compared with the increase in the number of deaths is causing much anxiety. A committee was appointed several months ago by the Académie de médecine of Paris to study methods of checking the drop in birth rate. At the April 26, 1938, meeting Professor Lereboullet submitted the report of the committee. The chief causes of the decline in the birth rate were found to be contraceptive methods and the wide-spread use of abortifacients or induced abortion. There were only 630,000 births in 1937 as compared to a little over a million in 1876. From 1935 to 1937, inclusive, there were 57,117 more deaths than births in France, as compared to an excess of 950,000 births over deaths in Germany and of 775,000 in Italy during 1936 and 1937. The committee believed that the causes of the denatality in France were chiefly moral and economic. It made the following recommendations: (1) That the gravity of the denatality question be made known to the public by every possible method. (2) That an appeal be made to the moral and spiritual forces of the country to encourage the raising of large families by granting large subsidies which increase proportionately to the number of children. (3) That the danger of induced abortions be impressed on the women of the country and that the laws already in existence which entail imprisonment and heavy fines for abortionists be rigorously applied.

DISCUSSION

THE CORRELATION BETWEEN IONIZATION IN THE IONOSPHERE AND SUN-SPOT NUMBERS

STUDIES of the ionosphere over a period of years have indicated a close correlation between the ionization in the ionosphere and the Wolf sun-spot numbers. A detailed analysis of the National Bureau of Standards data by Smith, Gilliland and Kirby[1] shows that the relation is particularly striking when 12-month running averages of critical frequencies and sun-spot numbers are compared. In the period of 1934 to 1937, the average sun-spot number increased from 5 to 110, while the average $f°_{F2}$ critical frequency at noon increased from 6.3 Mc/sec to 11.5 Mc/sec, corresponding to a range of electron concentrations from 1.38×10^6/cm³ to 1.42×10^6/cm³. Since noon values of electron concentration are nearly equilibrium values, the intensity of the ionizing radiation is proportional to the square of the electron concentration. Hence the intensity has increased about 14-fold, with an increase of 22-fold in the sun-spot number. In the same period the radiation producing ionization in the E layer and F_1 layer has increased by factors of 2.4 and 3, respectively. The correlation between sun-spot numbers and monthly averages of F_2 values is not so close, and Goodall[2] has shown that the solar characteristic giving the best correlation is the character figure for central zone calcium flocculi given in bulletins of the International Astronomical Union.

It is the purpose of this note to point out a possible reason for this correlation in the case of F_2 ionization. This ionization is variously ascribed to atomic oxygen, atomic nitrogen and molecular nitrogen,[3] but in all these cases the threshold wave-length for ionization is equal to or less than 910A. This is the Lyman series limit of hydrogen, and because the solar atmosphere is largely hydrogen in the normal state, its atmosphere will be extremely opaque for wave-lengths less than 910A. The light of a given wave-length comes from a depth in the solar atmosphere which varies inversely as the opacity at that wave-length, the average depth being such that the radiation is reduced to 1/e. Taking the atomic absorption coefficient as 0.6×10^{-17} it follows that the radiation occurs at a level where the hydrogen pressure is 3×10^{-3} dynes. The pressure at the photosphere[4] for visible radiation is roughly 300 dynes/cm² so the ionizing radiation comes from a level of the chromosphere several thousand kilometers above the photosphere.

[1] *Jour. Research*, NBS 21: 835, RP-1159, 1938.

[2] "The Solar Cycle and the F_2 Region of the Ionosphere." In press.

[3] Hulburt, *Phys. Rev.*, 53: 344, 1938; Wulf and Deming, *Terr. Mag. and Atmos. Elec.*, 43: 283, 1938.

[4] Unsöld, "Physik der Sternatumosphären," Julius Springer, 1938.

The opacity at 910A is comparable with the opacity in the strongest solar absorption lines. The atomic absorption coefficient of Hα is roughly 10^4 times that at the Lyman limit, but since less than 10^{-8} atoms per cm^3 are in a state to absorb Hα the opacity at Hα is much less than at 910A. The opacity in the K line of Ca^+ is estimated[4] to be roughly 4,000 times the opacity near the center of Hα and is comparable in order of magnitude with the opacity at the Lyman limit.

A spectroheliogram made with the K line of Ca^+ gives a photograph of the solar atmosphere near the pressure level for emission of radiation beyond the Lyman limit. The picture is complicated by Doppler effect and by variations in chemical composition of the atmosphere, but primarily it gives a picture of the temperature distribution over the sun at the given pressure level. The spectroheliogram is characterized by bright flocculi in the region of sun-spots, while most of the disk is relatively dark. This contrast would be enormously enhanced in the far ultra-violet for a spot 4 times as bright as the solar disk at 3,900A would be 400 times as bright at 910A.

Roughly quantitative considerations show that nearly all the ionizing radiation must come from bright spots rather than the disk as a whole. It has been shown[5] that if the disk radiated as a black body at 6,000°, the quanta of wave-length less than 910A could account for the F_2 ionization, but there is no reason to assume that the solar atmosphere at these low pressures is at 6,000°. The temperature as measured by the brightness at the center of a strong absorption line is less than 5,000° and the radiation at 5,000° can not account for 1 per cent. of the observed effect. However, if less than 1 per cent. of the solar disk is at a temperature of 7,500° or more, these bright spots could account for the observed ionization. The hypothesis that nearly all the ionizing radiation comes from the flocculi normally associated with sun-spots can well account for the type of correlation found between F_2 ionization and sun-spot numbers. The average intensity over long periods of time will be nearly proportional to the number of spots, simply because flocculi are associated with spots; but because of variation in brightness of flocculi, the day-to-day values will vary in a random way. A similar correlation is found between the "character figures" giving the number and brightness of K flocculi and the sun-spot numbers.

Ionization of the E layer probably comes from molecular oxygen[6] with a threshold near 1,000A, and bright line emission of Lyman lines in the flocculi may be an effective source of ionization. There is no basis for predicting the relative effectiveness of the radiation of the solar disk and the flocculi in this spectrum range, but the variation of E-layer ionization with sun-spot number indicates that at sun-spot maximum more than half the effect comes from flocculi, while at minimum most of the effect comes from the disk as a whole. The origin of F_1 ionization is quite uncertain, but the rate of variation with sun-spot number suggests that the threshold is at a wave-length greater than 910A.

It is well recognized that bright chromospheric eruptions produce radio fade-out,[7] but the disturbance seems to come from ionization below the E layer with little or no change in the F layer.[8] The radiation from normal flocculi rather than from these transient eruptions must be invoked to explain F_2 ionization.

The above considerations indicate that F_2 ionization can not be maintained by the temperature radiation from the solar disk as a whole. The hypothesis that the ionizing radiation comes from bright flocculi accounts for the observed correlation between ionization and sun-spot numbers, but it will be a difficult problem to show whether or not the continuous radiation from these bright spots can quantitatively account for the ionization.

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[4] Hulburt, *Phys. Rev.*, 53: 344, 1938.
[6] Wulf and Deming, *loc. cit.*
[7] Dellinger, *Jour. Research* NBS, 19: 111, 1937.
[8] Dellinger, *Phys. Rev.*, 50: 189, 1936.

A WHALE SHARK IN THE HAWAIIAN ISLANDS

IT is interesting to note that the whale shark, *Rhineodon typus*, can be said almost to abound in both the western and the eastern waters of the Pacific Ocean. But it has been so sparingly reported from the Central Pacific, that it might be thought almost absent from those vast reaches. Hence definite information of its occurrence in the Hawaiian Islands seems worthy of record.

Of its relative abundance in the western Pacific from the eastern coast of Japan to that of New South Wales in Australia, I have brought together all the evidence as of December 31, 1934, in an article on the geographical distribution of this greatest of the sharks.[1] As of that date 26 specimens were listed from the Western Pacific, and 15 of these were from Philippine waters. This abundance and the fact that it had been known (but not described) in these waters since 1800 (first record, 1816) lead me to believe that *Rhineodon* originated in the Philippine-Sulu Sea region and was distributed thence by ocean currents to all parts of the three great central oceans. This article was illustrated with maps showing all recorded occurrences.

Interestingly enough, *Rhineodon* seems almost as abundant in eastern Pacific waters—along the shores of the Americas from Lower California to Callao in Peru. I produced records for 23 specimens, of which 14 are listed from the lower part of the Gulf of California—

[1] E. W. Gudger, *Proc. Zool. Soc., London*, pt. 2, 863-893, pl. and 2 charts, 1934.

mainly around Cape San Lucas. Since that date, Dr. William Beebe has found them almost abundant and almost tame in those same waters. And more recently (1938), I have recorded that whale sharks are so abundant on the outer coast of Lower California from Hippolito Point to Cape San Lucas and so entirely unafraid as to be almost a nuisance to the tuna fishermen.[2]

From the Central Pacific but two whale sharks have ever been reported so far as I know—and these interestingly enough from the same group of islands. In 1929, Rougier[3] described a *Rhineodon* skin in the little museum in Papeete, Tahiti. This had come from a 17.3-foot specimen taken at Takaroa, Tuamotu Archipelago, in 1928. The second record is one I made in 1937 of a whale shark about 40 feet long impaled on the bow of a steamer near Tikehau Atoll in the Tuamotus.[4]

To these two records, I am now fortunate in being able to add a specimen of the whale shark, found in Hawaiian waters. These data came to me through the courtesy of Captain G. S. Bryan, hydrographer, U. S. Navy Department. This is but the last of many accounts of the wide-spread occurrence of this great fish communicated by the Hydrographic Office—to which my debt is heavy. This excellent account, sent in by Second Officer R. C. Willson, of the S. S. *Mapele* of the Matson Navigation Company, San Francisco, has been forwarded to me, and from it the following data on coloration and behavior are put on record.

On September 4, 1938, the *Mapele* was moored off Kukuihaele Landing on the north coast of Hawaii in Lat. 20° 08′ N. and Long. 155° 33.5 E. At 2:30 P.M. local time, a whale shark was seen slowly and fearlessly swimming around the ship among the sweepings and larger debris thrown overboard. The shark, seen by all hands, was about 25 feet long and about 4 feet wide across the broad blunt head. The description of the markings indubitably identify this fish as a whale shark. The head was covered with many white spots varying from one to two inches in diameter. These were scattered in random fashion over head and neck region. On the other hand, the body was covered with white spots in vertical rows separated by vertical white stripes. These extended from the back down the sides as far as the curve of the belly permitted sight. The rows of spots were about 6 inches apart, and the white stripes were about 2 inches wide. Spots and stripes both decreased in size from above downward and from the neck region toward the tail. The dorsal fin was about 18 inches high and had on it 7 distinct spots.

At about 3:30 the shark disappeared, but at 6:00 P.M. it was again seen swimming about under the stern amid slops and scraps thrown overboard from the ship's galley. "It swam leisurely around for about 20 minutes, bumping into the mooring lines a number of times. Once as it was swimming over one of the lines to a buoy the ship lifted, throwing the shark partly out of the water. Then it swam slowly off toward the west and was seen no more."

This behavior tallies almost exactly with the actions of another whale shark in swimming around a steamer in the harbor of St. Marc, Haiti, in 1937.[5] It is also very like that described of various specimens off the outer coast of Lower California. This great fish has no enemies and seems entirely unafraid of vessels and of men.

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TOXICITY OF THE SODIUM SALT OF DINITRO-o-CRESOL TO VENTURIA INAEQUALIS

POSSIBILITIES of direct chemical attack on fungi that cause certain types of plant disease now combated chiefly by repeated applications of protectant fungicides have been studied by the writer and associates.[1] It is sought by an eradicant fungicidal treatment at a vulnerable stage in the life-history of the pathogen to reduce the primary inoculum to a level at which the disease may be more surely and economically controlled. A preliminary report on further experiments with the apple scab pathogen, *Venturia inaequalis* (Cke.) Wint., follows.

In small-scale experiments in the spring of 1938, overwintered apple leaves bearing abundant mature ascocarps of *V. inaequalis* were sprayed with Elgetol, a proprietary preparation containing 12 per cent. by weight of the sodium salt of dinitro-o-cresol with a supplement to aid its penetration. Similar leaves sprayed with water served as controls. Studies of treated and untreated leaves indicated that Elgetol in water at 1 per cent. by volume reduced ascospore discharge by 99.7 per cent. (average of 3 trials).

Toximetric studies with agar plate cultures by a method reported by Palmiter and Keitt[2] indicate that the lethal concentration of Elgetol to the 2 isolates of *V. inaequalis* tested was near .05 per cent. by volume.

These small-scale experiments show that Elgetol has a high degree of eradicant effectiveness against *V. inaequalis*. Conclusions regarding its practical adap-

[2] E. W. Gudger, *Calif. Fish and Game*, 24: 420–421, 1938.

[3] Emm. Rougier, *Bull. Soc. Etudes Oceanogr.*, Papeete, 3: 318–319.

[4] E. W. Gudger, SCIENCE, 85: 2204, 314, 1937.

[5] E. W. Gudger, *Copeia*, 1: 60, 1937.

[1] G. W. Keitt and D. H. Palmiter, *Jour. Agr. Res.*, 55: 397–438, 1937.

[2] D. H. Palmiter and G. W. Keitt, *Jour. Agr. Res.*, 55: 439–452, 1937.

tation for apple scab control must await the results of further experiments, which are in progress.

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SEEDS FOR THE STUDY OF ROOT AND ROOT-HAIR STRUCTURE IN BOTANICAL LABORATORIES

IN connection with studies made of the invasion of the bunch grass prairies by weeds, extensive germinations were made with *Bromus tectorum* L., one of the most common and abundant weeds invading deteriorated prairies in western Montana.

Under ordinary laboratory conditions, *B. tectorum* germinates easily in two days, giving usually from 90 to 98 per cent. germination. Its very fine single seminal root appears to me a most excellent material for the study of root-hair structure in undergraduate laboratories. All zones of the young primary root can be easily seen under both low and high powers of the microscope. The root-hairs stand out very clearly and prominently, giving a full series from the youngest epidermal cell just bulging out to the fully developed hair, in which streaming of protoplasm is usually evident.

A very convenient way, without the use of blotters, is to scatter the seed in the moist chamber, in which water has been poured to a depth of say one half to one mm. The chamber may be placed either in a lighted or in a darkened place; in two or three days the roots will be of the proper length. The seeds will also germinate if dropped in a tumbler-full of water.

I'll be glad to send on the receipt of a mailed and stamped envelope enough seed for any size class.

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SPECIAL ARTICLES

ACTION OF KETENE ON THE PITUITARY LACTOGENIC HORMONE

IN their study of the acetylation of pepsin, Herriott and Northrop[1] found that the primary amino groups play no significant role in the activity of the pepsin molecule. Later, White[2, 3] reached the same conclusion in a study of insulin and emphasized the importance of the tyrosine molecule in all hormones of protein nature. In contrast with their conclusions we have found that the primary amino groups in the lactogenic hormone appear to be important for its biological activity.

The lactogenic hormone contains 0.53 per cent. amino nitrogen, as determined by Van Slyke gasometric apparatus. Herriott and Northrop have shown that amino groups are acetylated by ketene at room temperature in not more than five minutes, whereas the phenolic hydroxyl groups remain unchanged.[4] We have also found that ketene treatment for five minutes at room temperature was sufficient to block all amino groups in the lactogenic hormone. If the reaction is carried out at 0° C, for five minutes, only 30 per cent. of the amino groups is acetylated. The acetylation is achieved by passing a constant stream of ketene into a suspension which contains 10 mg protein per cc in pH 5.6 M acetate buffer. Ketene is obtained by the improved type of generator designed by one of us.[5]

All ketene experiments were done with a preparation of lactogenic hormone (Li-P)[6] which, as Table I shows, gives a pronounced reaction when a total dose of 1 mg is injected intramuscularly into one-month-old squabs.

It will be seen from the results in Table I that the free amino groups in lactogenic hormone are essential for its activity. The results of the present work are in contrast with those secured by Stern and White[7]

TABLE I

Lactogenic preparation (Li-P)	Amino groups acetylated per cent.	Dose/ Squab mg	Number of squabs	Crop sac reactions
Untreated	0	1.0	3	pronounced
Acetylated at 0° for 5 minutes	30	1.0	3	2 minimal 1 negative
Acetylated at 20° for 5 minutes ...	100	1.0	6	negative
	100	4.0	6	negative

in the acetylation of insulin, and are especially interesting because of several striking similarities in the two hormones. Stern and White treated insulin with the same reagent—ketene—under conditions similar to those here employed, and found that the free amino groups of insulin played no significant role in its phar-

[1] R. M. Herriott and J. H. Northrop, *Jour. Gen. Physiol.*, 18: 35, 1934–35.

[2] K. G. Stern and A. White, *Jour. Biol. Chem.*, 122: 371, 1938.

[3] A. White, Cold Spring Harbor Symposia on Quantitative Biology, 6: 262, 1938.

[4] There is as yet no experimental evidence to show that the phenolic hydroxyl of tyrosine in the lactogenic hormone is also important for its biological activity.

[5] C. H. Li, SCIENCE, this issue, page 143.

[6] The authors are most grateful to Dr. W. R. Lyons for the potent preparation of lactogenic hormone employed. The minimal effective dose was 0.2 mg when divided into four daily doses and administered intramuscularly. We have had the opportunity of studying a similarly potent preparation of adrenotropic hormone, due to the kindness of W. R. Lyons and H. D. Moon. The activity of adrenotropic hormone is not destroyed by ketene by five minutes of treatment. This method may conveniently eliminate the lactogenic activity in adrenotropic fractions.

[7] *Loc. cit.*

macodynamic action. These groups are essential for the activity of the lactogenic hormone.

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THE EFFECT OF COCARBOXYLASE UPON METABOLISM AND NEURO-PSYCHIATRIC PHENOMENA IN PELLAGRINS WITH BERIBERI[1]

THE present communication is a report of observations on eight selected cases of pellagra with beriberi which were studied from chemical, neurological and psychiatric standpoints. Preceding and following the administration of cocarboxylase, each patient was studied repeatedly by the following methods: (1) Analysis of blood samples for metabolites, including sulfite combining substances. (2) Neurological examination, including chronaximetric measurement. (3) Estimation of the psychiatric status.

The intravenous administration of 50 milligrams of cocarboxylase (Merck) to persons who exhibited signs of an "active process" was followed, in every instance, by dramatic and rapid improvement. The bisulfite-binding substances decreased in quantity. The pathological signs of peripheral and cranial nerves, which had become increased in patients who were being treated with nicotinic acid and riboflavin, became less conspicuous or disappeared. The irritability of a number of muscles, measured in terms of their strength-duration curves, returned from underexcitability before treatment to normal values and in some cases even progressed to overexcitability. Correspondingly, the increased threshold of sensibility to touch and prick in arms and legs was reduced to normal, and the depressed pupillary and corneal reflexes improved quantitatively, often becoming normal.

Following the administration of cocarboxylase, some beneficial effect occurred, in some persons within an hour and in all persons within four hours. Improvement continued for from one to four days thereafter. Since the unbalanced diets of these persons remained essentially unchanged, in the absence of further therapy the patients tended to regress rapidly to their condition preceding treatment. A psychoneurotic syndrome which was recognized in these persons and which responded promptly to the administration of cocarboxylase will be described separately. In contrast, in the persons selected for control, there was no decrease of bisulfite-binding substances in the blood and no improvement in the neurological and psychoneurotic symptoms following cocarboxylase therapy.

The present study shows that the neuropathy accompanying pellagra represents a clinical entity (beriberi), distinct from a deficiency of nicotinic acid or of riboflavin. It shows also that cocarboxylase (pyrophosphate of thiamin) has a striking effect upon certain intermediate products of carbohydrate metabolism and induces improvement in the affected peripheral and cranial nerves. Furthermore, the decrease of bisulphite-binding substances in the blood is accompanied by a decrease or disappearance of certain neurological signs and of psychoneurotic symptoms.

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EVIDENCE FOR THE EXISTENCE OF A RESPIRATORY NEUROHORMONE

IN the course of studies on the pressor effects of acetylcholine, it was observed that amounts of acetylcholine which produce pressor effects and contraction of the nictitating membrane also increase the rate and depth of respiration for brief intervals. It was also observed that the larger the dose of acetylcholine the longer the duration of respiratory stimulation and the greater the depth of respirations. The pressor effect always outlasts the respiratory stimulation.

The minimum amounts of acetylcholine producing respiratory stimulation in atropinized dogs and cats are 0.15 to 0.2 mgm or more per kilogram, but in the presence of optimum amounts of eserine (about 1.5 mgm per kilogram) as little as 0.005 mgm of acetylcholine may produce respiratory stimulation. If 0.05 mgm of acetylcholine is used throughout in atropinized animals, the smallest dose of eserine which is required to produce respiratory stimulation from this amount of acetylcholine is 0.04 to 0.05 mgm per kilogram. In the same animals doses of epinephrine which produced blood pressure elevation and withdrawal of the nictitating membrane also caused a decrease but never an increase in the rate of respiration.

In five cats and eight dogs the carotid sinuses were removed and in some of these animals the vagi above the ganglia nodosa as well as the sympathetics above the superior cervical ganglia were sectioned. In these animals, which were treated with atropine and eserine,

[1] From the Department of Neurosurgery, Hospital of the University of Pennsylvania, Philadelphia, Pennsylvania; Department of Physiology and Pharmacology, Albany Medical College, Albany, New York; Department of Psychiatry, University of California, Berkeley, California; and Department of Internal Medicine, University of Cincinnati General Hospital, Cincinnati, Ohio. This study was aided by grants from the Child Neurology Research (Friedsam Foundation) and from the Rockefeller Foundation.

0.05 to 0.1 mgm of acetylcholine did not produce respiratory stimulation.

In another group of animals treated with atropine and eserine, 3 to 6 mgm of nicotine per kilogram abolished not only the pressor effects of acetylcholine but also diminished or abolished its respiratory stimulant action.

The respiratory effect of intravenously administered acetylcholine appears after a delay of seven to twenty seconds, and slow or rapid injection of comparable doses into the common carotid artery does not accelerate the onset of the respiratory effect. In several dogs acetylcholine in doses effective as respiratory stimulants when administered by the femoral vein produced no or feeble respiratory stimulation when given by the carotid artery.

It is concluded that the respiratory stimulation following acetylcholine injections depends upon the presence of the carotid body and that the active principle is not acetylcholine but a sympathin liberated at the nerve terminations following stimulation of sympathetic ganglia by acetylcholine. Nicotine prevents this stimulation by producing ganglionic paralysis or depression. Examination of the tracings published by Magoun, Ranson and Hetherington[1] and by Harrison, Wang and Berry[2] reveals that sympathins liberated following hypothalamic stimulation in adrenalectomized animals produce not only pressor effects and withdrawal of the nictitating membrane but also marked and brief stimulation of respiration.

It is tentatively suggested that a sympathin, not identical with epinephrine, possesses (via the carotid bodies) properties of a respiratory stimulant.

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THE REDUCING GROUPS OF EGG ALBUMIN

IT has long been known that SH reducing groups can be detected by the nitroprusside test in denatured but not in native egg albumin. In some other proteins SH groups can be detected with nitroprusside even when the protein is native.[1] Various methods have been developed for the quantitative study of protein-reducing groups.[2, 3, 4]

In the present experiments measurements are made of the amount of ferricyanide reduced by denatured egg albumin in the presence of the synthetic detergent Duponol PC and of the effects on the amount of ferricyanide reduced of previous reactions of the protein with iodine and iodoaceticacidamide. These experiments show the kinds of complications which may be involved in the study of protein groups generally. They also illustrate some of the remarkable effects of synthetic detergents on proteins, which I shall describe more completely elsewhere.

At pH 9 ferricyanide oxidizes not only the SH groups of denatured egg albumin but weaker reducing groups as well. The amount of ferrocyanide formed is greater the longer the time of reaction and the higher the concentration of ferricyanide.[5] This also is true at pH 6.8. In addition, the results at pH 6.8 are variable because they depend on the physical state of the denatured protein. Other things being equal, the more the denatured protein is aggregated,[6] the less ferrocyanide is formed.

If, however, denatured egg albumin is oxidized by ferricyanide at pH 6.8 in the presence of Duponol PC, the oxidation takes place at a much lower concentration of ferricyanide than in the absence of Duponol, and the amount of ferrocyanide formed is independent, within wide limits, of the time and temperature of the reaction and of the concentrations of ferricyanide and Duponol. No reduction of ferricyanide takes place if the SH groups of denatured egg albumin are first abolished with formaldehyde or iodoaceticacidamide.

The proper conditions for the reaction between ferricyanide and denatured protein vary from protein to protein. In the case of egg albumin, the reaction is carried out for 10 minutes at 37° C. in 3 cc of a pH 6.8 solution containing 0.002 mM of ferricyanide and 10 mg of Duponol PC (du Pont), a mixture of the C_{10}—C_{18} compounds of $CH_3(CH_2)_n CH_2OSO_3Na$. 0.001 mM of ferrocyanide are formed from 10 mg of denatured egg albumin. There is no increase in the amount of ferrocyanide formed if the reaction is carried out for 100 minutes instead of for 10 minutes or if the rate of reaction is increased by increasing the amount of ferricyanide 25 times and the amount of Duponol 10 times or by raising the temperature from 37° to 100° C.

Urea[7] and guanidine,[8] like Duponol, promote the

1 Magoun, Ranson and Hetherington, *Amer. Jour. Physiol.*, 119: 615, 1937.

2 Harrison, Wang and Berry, *Amer. Jour. Physiol.*, 125: 449, 1939.

1 M. L. Anson, "The Chemistry of Amino Acids and Proteins," Chapter IX. Edited by C. L. A. Schmidt, Springfield, 1938.

2 A. E. Mirsky and M. L. Anson, *Jour. Gen. Physiol.*, 18: 307, 1935.

3 R. Kuhn and P. Desnuelle, *Zeits. Physiol. Chem.*, 251: 14, 1938.

4 J. P. Greenstein, *Jour. Biol. Chem.*, 125: 501, 1938.

5 A. E. Mirsky and M. L. Anson, *Jour. Gen. Physiol.*, 19: 451, 1936.

6 M. L. Anson and A. E. Mirsky, *Jour. Gen. Physiol.*, 15: 341, 1932.

7 I have used urea for many years to promote the reaction between protein-reducing groups and the uric acid reagent.

8 Greenstein (see note 4) has studied the effect of guanidine on the oxidation of denatured egg albumin by porphyrindin. I shall discuss his results elsewhere.

ferricyanide reaction. They are much less effective reagents than Duponol.

Ferricyanide, iodine and iodoaceticacidamide all react with the SH groups of simple SH compounds like cysteine, which is a constituent of egg albumin. Ferricyanide, although it reacts with denatured egg albumin, does not react with native egg albumin.[5] Iodine and iodoaceticacidamide, nevertheless, do react with native egg albumin. 10 mg of native egg albumin treated with 1 cc of 0.0015 N iodine at pH 3.2 and then neutralized and denatured by Duponol, no longer reduces dilute ferricyanide. 10 mg of native albumin treated with 0.01 mM of iodoaceticacidamide at pH 9 and then denatured reduces only half as much ferricyanide as untreated albumin.

In connection with the observation that native egg albumin reacts with iodoaceticacidamide but not with ferricyanide, it is interesting to note that urease is inactivated by iodoaceticacidamide[9] but not by ferricyanide.[10] The effect of iodoaceticacidamide on viruses is now being tested.

The fact that ferricyanide does not react with native egg albumin does not prove that the SH groups of native egg albumin are linked or inaccessible. On the other hand, it can not be assumed, without independent evidence, that in the present experiments ferricyanide, iodine and iodoaceticacidamide are reacting only with SH groups. All three of these reagents can, under suitable conditions, react with protein groups other than SH groups. It is possible, furthermore, that there are reducing groups in denatured egg albumin which are not SH groups but which are oxidized by dilute ferricyanide only in the presence of SH groups.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

AN IMPROVED TYPE OF KETENE GENERATOR

RECENTLY Herriott[1] described a ketene generator which was improvised from that previously suggested by Ott, Schroter and Packendorf.[2] In our studies of the acetylation of pituitary hormones we have developed a new design of generator, giving a more efficient and workable apparatus. A diagram is given in Fig. 1.

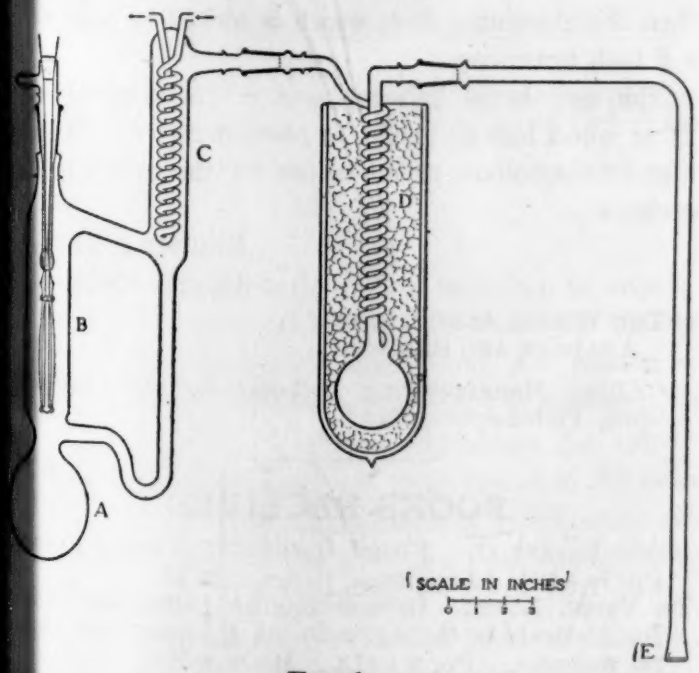

FIG. 1

Vaporized acetone from flask A is decomposed by the heating filament B, which is kept at a bright-red heat. The mixed vapors pass through the condenser C in order to remove the unchanged acetone vapor and most of the ketene polymers. More complete removal of these two substances is then effected by the trap D, which is immersed in a freezing mixture of salt and ice. Ketene then passes into the solution through a sintered glass plate E. The sintered glass plate is particularly useful for bubbling gas; it gives more effective contact between the solution and the gas, and it stirs the solution sufficiently to make unnecessary a mechanical stirrer as generally suggested.

The removable filament-support is the same as described by Herriott. The 40 mill tungsten leads are sealed permanently into the glass and the replaceable tungsten filament (15 mill) may be attached to them in the manner illustrated in the figure. The rate at which ketene is generated can be controlled by varying the current which passes through the heating filament.

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A SIMPLE AND EFFICIENT PRECIPITATE DRYER

IN the course of preparing enzymes, protein was precipitated with ammonium sulfate at 70 per cent. saturation. The filtered, wet precipitate contained a large amount of mother liquor. If the precipitate was allowed to dry on the filter paper more than half its dry weight would be salt and not the active material desired. Drying first on blotting paper and then on a porous plate was tried. By this method all the water was absorbed; but as it began to evaporate,

[1] R. M. Herriott, *Jour. Gen. Physiol.*, 18: 69, 1934.
[2] E. Ott, R. Schroter and K. Packendorf, *Jour. Prakt. Chem.*, 130, N.S.: 177, 1931.

[9] C. V. Smythe, *Jour. Biol. Chem.*, 114: 601, 1936.
[10] L. Hellerman and M. E. Perkins, *Jour. Biol. Chem.*, 107: 241, 1934.

ammonium sulfate was redeposited as an efflorescence on the surface of the protein precipitate.

A method was devised which reduces efflorescence to a minimum, purifies the protein precipitate and shortens drying time. An apparatus was constructed which consisted of a galvanized iron box open on one side. Inside the box, on the bottom, an electric socket is fastened and the wires pass through a hole in one side. In the top, over the lamp and also along the lower edge of each side of the box, holes are bored to allow circulation of air. A drying plate, made of plaster of Paris, about five eighths of an inch thick, fits vertically into the open side, closing the box. This face plate is pushed into the open side of the box until flush with the outer edges. It should fit snugly. In order to be able to remove the plate easily, thumb holes are made by cutting out a small "V" from the middle of each edge against which the plate rests.

Before use the plate should always be oven dried. A 60- or 75-watt lamp is then placed in the socket, the plate adjusted, and the lamp turned on for 5 or 10 minutes to allow the box to warm up. The precipitate is removed from the filter paper, roughly dried on blotting paper and spread in a thin layer on the surface of the plaster plate. The plaster absorbs the mother liquor. As the inside surface is at a higher temperature than the outside, most of the evaporation takes place there, and ammonium sulfate deposits on the inside face. The protein meanwhile dries readily on the outside. When dried to the point of cracking into small pieces it can be scraped off and ground to a powder in a mortar.

The plaster plate is reconditioned for further work by completely scraping off the last traces of any remaining precipitate with a knife or spatula. If the apparatus remains unused for some time the plate should be dried in an oven before use, as it will have become saturated with moisture from the air.

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TURNTABLE FOR EXERCISING RATS

THE turntable herewith described is very satisfactory for exercising rats. It is permanent, inexpensive and easily removed from the cage for cleaning. This new exerciser has been tested thoroughly in the dormer cage[1] used in the animal colony of The Wistar Institute.

It consists of an aluminum disc[2] (Fig. 1) 12½ inches in diameter of 3S18 gage sheet aluminum of 20-minute alumilite finish, with a ¼ inch outer edge flange for

[1] M. J. Greenman and F. L. Duhring, "Breeding and Care of the Albino Rat for Research Purposes," 2nd ed., The Wistar Institute, Philadelphia, Pa., 1931.

[2] The Aluminum Cooking Utensil Company, New Kensington, Pa.

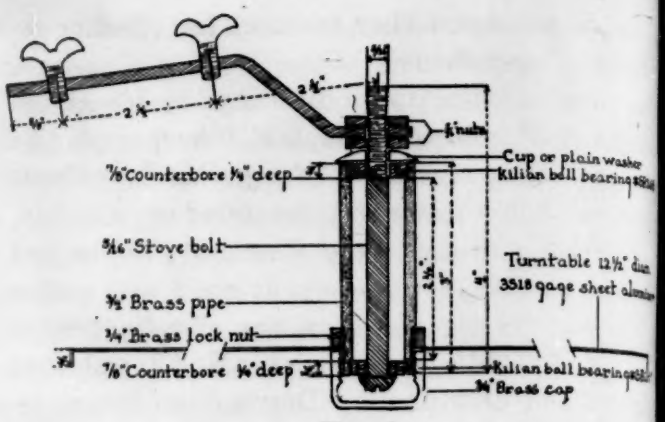

FIG. 1

strength, and a center hole of 1–1/16 inches. This new disc replaces the monel metal and stainless steel disc used formerly, preventing pitting caused by animal excretions and the brittleness in the metal with consequent cracking around the hole.

The housing is made from a piece of standard ½ inch brass pipe, 3 inches in length, threaded on one outer end, with a ⅞ inch counterbore on each end ¼ inch deep. Inserted in each counterbore is ⅞ inch × ¼ inch Kilian ball bearing[3] SR 268, 5/16 inch bore. A 5/16 round head stove bolt, 4 inches in length, serves as a shaft. The stove bolt is inserted in the thread end of the housing, through the ball bearings, covered with a brass washer and locked with a 5/16 inch standard hexagonal nut. On one end of bolt is placed a 1 inch × ⅛ inch × inch hanger of galvanized steel for fastening to the ceiling of the cage with two ¼ inch thumb screws. On threaded end of housing is placed a ¾ inch lock nut, then the aluminum disc, which is locked in place with a ¾ inch brass cap.

The new brass hub replaces the modified bicycle front wheel hub and axle, to prevent rusting. It costs about two dollars to make one of the new type exercisers.

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[3] Kilian Manufacturing Corporation, 1640 Fairmount Avenue, Philadelphia, Pa.

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